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Methods for Assessing Exposure to Chemical Substances

Volume 2

Methods for Assessing Exposure to Chemical Substances in the Ambient Environment

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This document is the second in a series of volumes developed for the U.S. Environmental Protection Agency, Office of Toxic Substances to assist in the assessment of exposure to chemical substances. This report presents methods that can be used to estimate exposure to chemical substances in the ambient environment and includes many tools, data sources, and models that are useful in the exposure estimation procedures.

This volume is organized to reflect the flow of information in an ambient exposure assessment. Sections 2 and 3 provide information on the preliminary data required, i.e., production volume, physicochemical properties, and uses of the chemical substance. Section 4 contains a description of the avaialbility and use of monitoring data bases and how monitoring data are integrated in the overall methods. Section 5 indicates how the population methods (Volume 4) fit into the overall process. Section 6 is the core of this volume; it addresses the analytical framework for calculating exposure and discusses how to access appropriate data for each of the analytical elements. To supplement the text, an Information Resource Matrix which indexes data bases and other resources is included as Appendix A; a list of chemicals studied and regulated by federal agencies as of 1984 is provided as Appendix B; and examples of pertinent data base outputs are given in Appendix C.

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METHODS FOR ASSESSING EXPOSURE TO CHEMICAL SUBSTANCES

Volume 2

Methods for Assessing Exposure to Chemical Substances in the Ambient Environment

by

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FOREWORD

This document is one of a series of volumes, developed for the U.S. Environmental Protection Agency (EPA), Office of Toxic Substances (OTS), that provides methods and information useful for assessing exposure to chemical substances. The methods described in these volumes have been identified by EPA-OTS as having utility in exposure assessments on existing and new chemicals in the OTS program. These methods are not necessarily the only methods used by OTS, because the state-of-the-art in exposure assessment is changing rapidly, as is the availability of methods and tools. There is no single correct approach to performing an exposure assessment, and the methods in these volumes are accordingly discussed only as options to be considered, rather than as rigid procedures.

Perhaps more important than the optional methods presented in these volumes is the general information catalogued. These documents contain a great deal of non-chemical-specific data which can be used for many types of exposure assessments. This information is presented along with the methods in individual volumes and appendices. As a set, these volumes should be thought of as a catalog of information useful in exposure assessment, and not as a "how-to" cookbook on the subject.

The definition, background, and discussion of planning exposure assessments are discussed in the introductory volume of the series (Volume 1). Each subsequent volume addresses only one general exposure setting. Consult Volume 1 for guidance on the proper use and interrelations of the various volumes and on the planning and integration of an entire assessment.

The titles of the nine basic volumes are as follows:

Volume 1	Methods for Assessing Exposure to Chemical Substances (EPA 560/5-85-001)
Volume 2	Methods for Assessing Exposure to Chemical Substances in the Ambient Environment (EPA 560/5-85-002)
Volume 3	Methods for Assessing Exposure from Disposal of Chemical Substances (EPA 560/5-85-003)
Volume 4	Methods for Enumerating and Characterizing Populations Exposed to Chemical Substances (EPA 560/5-85-004)
Volume 5	Methods for Assessing Exposure to Chemical Substances in Drinking Water (EPA 560/5-85-005)

Volume 6	Methods for Assessing Occupational Exposure to Chemical Substances (EPA 560/5-85-006)
Volume 7	Methods for Assessing Consumer Exposure to Chemical Substances (EPA 560/5-85-007)
Volume 8	Methods for Assessing Environmental Pathways of Food Contamination (EPA 560/5-85-008)
Volume 9	Methods for Assessing Exposure to Chemical Substances Resulting from Transportation-Related Spills (EPA 560/5-85-009)

Because exposure assessment is a rapidly developing field, its methods and analytical tools are quite dynamic. EPA-OTS intends to issue periodic supplements for Volumes 2 through 9 to describe significant improvements and updates for the existing information, as well as adding short monographs to the series on specific areas of interest. The first four of these monographs are as follows:

Volume 10	Methods for Estimating Uncertainties in Exposure Assessments (EPA 560/5-85-014)
Volume 11	Methods for Estimating the Migration of Chemical Substances from Solid Matrices (EPA 560/5-85-015)
Volume 12	Methods for Estimating the Concentration of Chemical Substances in Indoor Air (EPA 560/5-85-016)
Volume 13	Methods for Estimating Retention of Liquids on Hands (EPA 560/5-85-017)

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1. INTRODUCTION

1.1 Purpose and Scope

Under the Toxic Substances Control Act (PL 94-469), the U.S. Environmental Protection Agency (EPA) is responsible for performing exposure assessments on toxic chemicals. To help organize data collection and analysis, exposure can be divided into seven areas or scenarios: occupational exposure, consumer exposure, exposure resulting from transportation spills, exposure resulting from disposal operations, exposure through food, exposure through drinking water, and exposure to the general population resulting from toxic chemicals in the ambient environment. This report presents methods for assessing exposure in the last area, i.e., the ambient scenario.

The ambient scenario is the most diverse of all the scenarios, and includes exposure to toxic chemicals from a variety of sources, including industry, natural releases, inadvertent production, and non-point or area sources. Toxic chemical releases from disposal-related activities and transportation-related spills contribute to ambient exposure. However, these subjects are addressed in separate volumes because of their complexity and the quantity of available data.

The methods discussed herein have been developed in two phases: feasibility and method development. Phase I, feasibility, addressed five basic issues:

1. What methods already exists or are being developed?
2. What data bases or information sources are pertinent?
3. What is the feasibility of developing simple models or algorithms for predicting exposure?
4. What generic data exist that can be used in many exposure assessments?
5. What are the alternative approaches for assessing ambient exposure?

The primary conclusion of the Phase I effort was that development of general methods was feasible and that a number of data bases, algorithms, and techniques are available for assessing exposure to chemicals under a wide variety of circumstances. This volume is the product of Phase II, Methods Development, and it discusses the analytical framework, techniques, and data bases that were identified during Phase I.

This report presents methods which can be used to estimate exposure to toxic chemicals in the ambient environment and includes many tools, data sources, and models which are useful in the exposure estimation procedures. They are not, by any means, the only tools, data sources, or models. To locate, compile, and describe all alternatives available would have consumed more resources than were available and would have created a great deal of confusion to the reader. Those that are described here are used by the Office of Toxic Substances (EPA) and can be used by others, subject to the limitations of each.

1.2 Report Organization

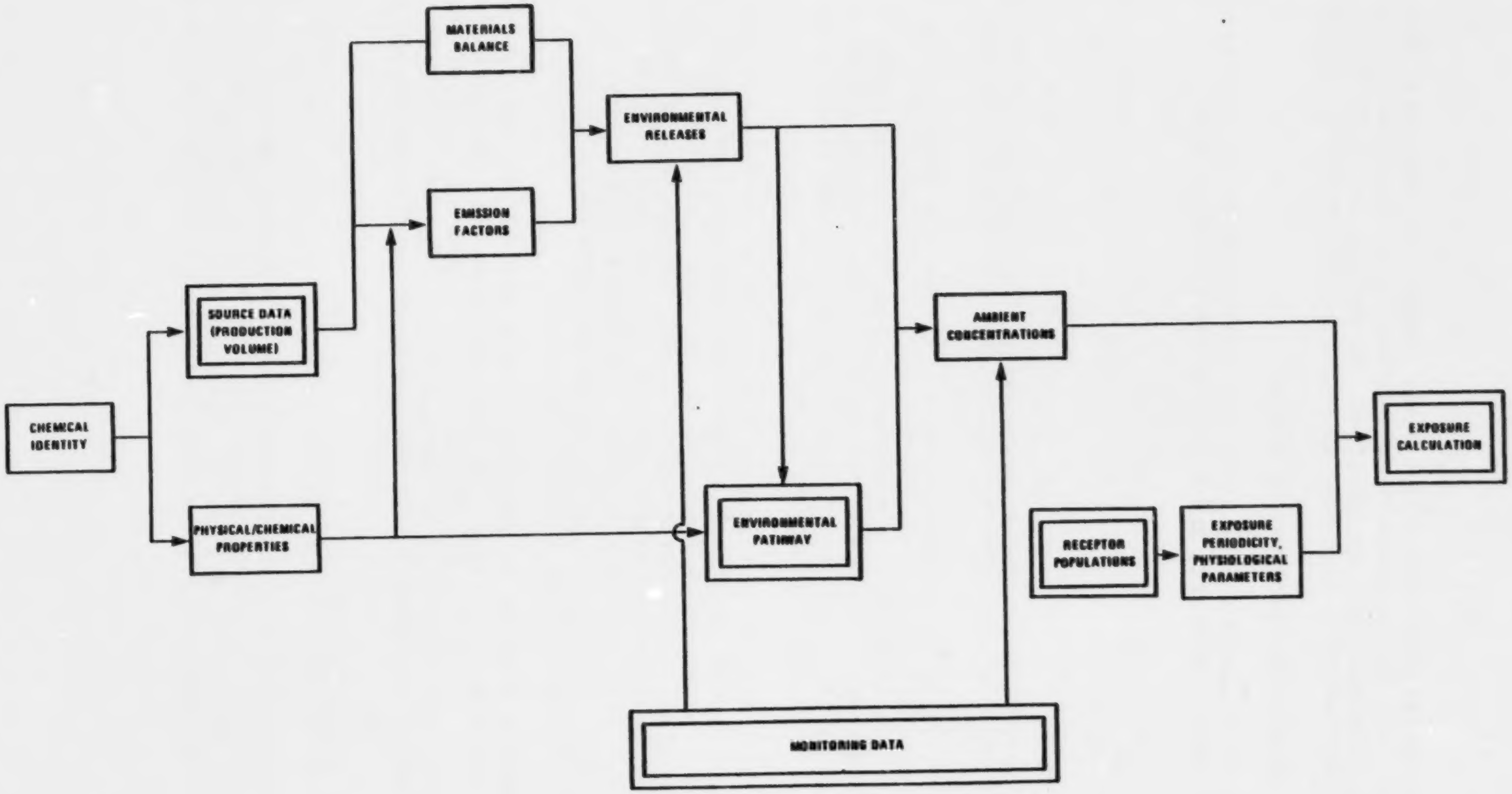
This volume is organized to reflect the flow of information in an ambient exposure assessment. Sections 2 and 3 provide information on the preliminary data required, i.e., production volume, physicochemical properties, and uses of the chemical substance. Section 4 contains a description of the availability and use of monitoring data bases and how monitoring data are integrated in the overall methods. Section 5 indicates how the population methods (Volume 4) fit into the overall process. Section 6 is the core of this volume; it addresses the analytical framework for calculating exposure and discusses how to access appropriate data for each of the analytical elements. Figure 1 depicts the information flow for ambient exposure assessment, as well as the relationships between the major sections in this volume.

To supplement the text, an Information Resource Matrix which indexes data bases and other resources is included as Appendix A; a list of chemicals regulated by federal agencies is provided as Appendix B; and examples of pertinent data base outputs are given in Appendix C.

1.3 Framework for Calculation

The methods for calculating exposure are described and illustrated below. Methods differ for each of the exposure routes and are discussed separately. Units are for example only, since the ultimate determinant of which units to use will often depend on the nature of the hazard presented by the chemical.

In general ambient exposure analysis, ingestion exposures are typically not as important as dermal or inhalation exposures. The ingestion exposure route would only be applicable under unusual circumstances when (1) particles are trapped and swallowed following respiration, or (2) receptors (particularly children) eat dust or soil, that results in an appreciable amount of absorbed material relative to dermal and/or inhalation exposures. Ordinarily, exposure via inhalation or dermal absorption would accompany both of the cases described above


MATERIALS BALANCE
ENVIRONMENTAL RELEASES
EMISSION FACTORS
SOURCE DATA (PRODUCTION VOLUME)
AMBIENT CONCENTRATIONS
CHEMICAL IDENTITY
EXPOSURE CALCULATION
PHYSICAL/CHEMICAL PROPERTIES
ENVIRONMENTAL PATHWAY
RECEPTOR POPULATIONS
EXPOSURE PERIODICITY, PHYSIOLOGICAL PARAMETERS
MONITORING DATA

LEGEND:

DOUBLE BOX SIGNIFIES MAJOR SECTION HEADING IN THIS VOLUME.

SINGLE BOX SIGNIFIES TOPIC COVERED WITHIN SECTION 8,
"CALCULATING EXPOSURES."

FIGURE 1. INFORMATION FLOW FOR ASSESSING AMBIENT EXPOSURES

resulting in far more significant doses (amount absorbed) than that from ingestion. For the purposes of this method, only inhalation and dermal exposures of humans will be addressed. No methods for quantifying exposure via ingestion have been developed or are typically used by OTS.

1.3.1 Inhalation Exposures of Humans

Figure 2 illustrates the analytical components of the inhalation exposure route. Note that the following relationships hold:

$$S = C \times V$$
$$P = F \times D$$
$$E = S \times P$$
$$I = A \times E$$

For most general and long-term assessments, the frequency term, F, will be unity, and P will be directly equivalent to D in hours per year.

Inhalation of air containing toxic chemicals can result in at least three types of exposure: (1) via deposition in the lungs, (2) via deposition in the gastrointestinal tract, and (3) via deposition in the mucosal membranes. The latter two modes of exposure result from initial deposition of particles in the upper respiratory tract (pharynx and trachea). This report concentrates only on the first.

Particles ranging in size from 0.01 to 100 µm will undergo both pulmonary and upper respiratory deposition, and particles smaller than 0.01 µm will generally be deposited in the lungs (Leidel et al. 1977, Silverman et al. 1971, Becker et al. 1979). Of the inhaled toxic substances, some portion may be exhaled, thus not available for absorption. Loss through exhalation is difficult to quantify; it is usually taken into account in the absorption term (which is typically expressed as a percentage of exposure).

Absorption rate (A) is factored in only when effects data are based on absorbed dose. Otherwise, the exposure value E is the endpoint of the calculation. Estimating absorption rate is beyond the scope of this methodology; the discussion of the analytical components provided in subsection 6.2 addresses all of the component terms except absorption rate.

1.3.2 Dermal Exposures of Humans

Figure 3 represents the framework for calculating exposure via the dermal route and is similar to that for inhalation. Exposure (E) is derived in the same fashion as was described for inhalation, with availability (Av) analogous to ventilation rate. Availability is the

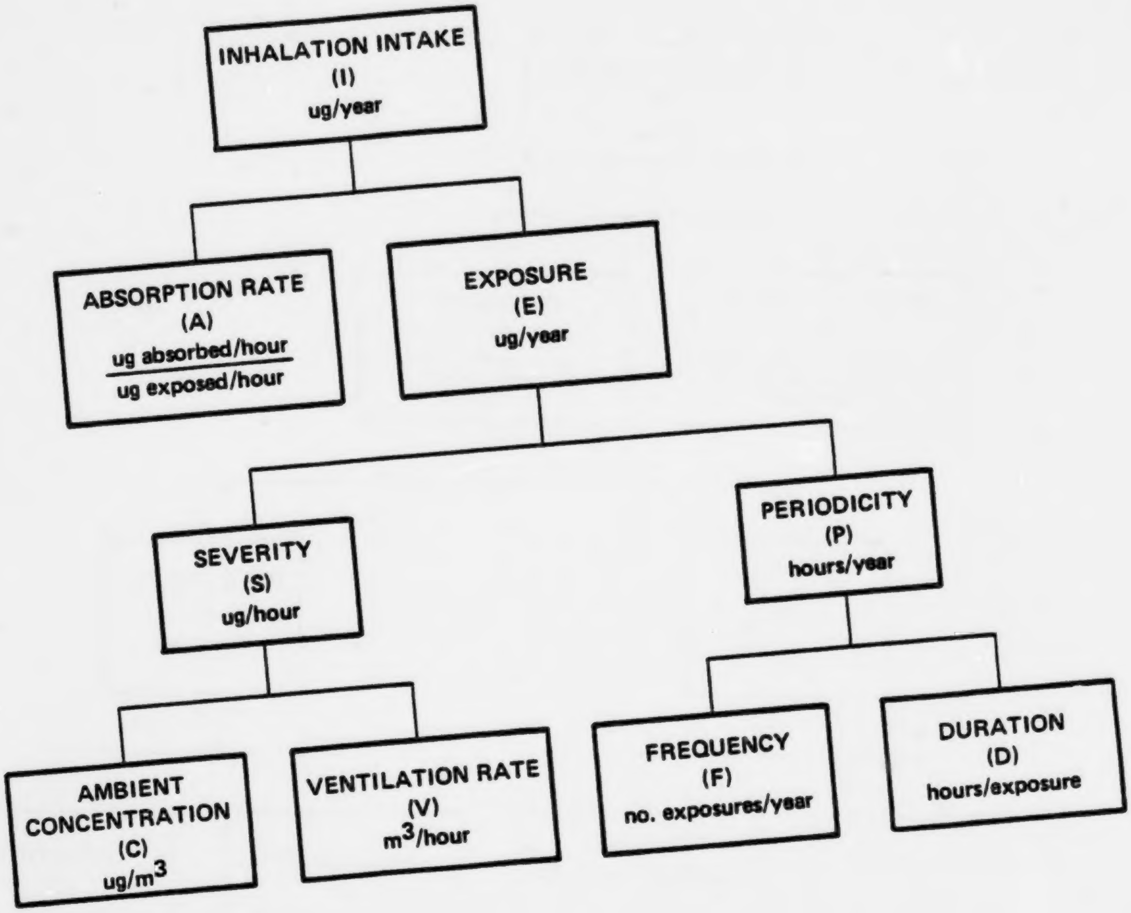

INHALATION INTAKE
(I)
ug/year
ABSORPTION RATE
(A)
ug absorbed/hour
ug exposed/hour
EXPOSURE
(E)
ug/year
SEVERITY
(S)
ug/hour
PERIODICITY
(P)
hours/year
AMBIENT CONCENTRATION
(C)
ug/m3
VENTILATION RATE
(V)
m3/hour
FREQUENCY
(F)
no. exposures/year
DURATION
(D)
hours/exposure

FIGURE 2. EXPOSURE FRAMEWORK: INHALATION ROUTE

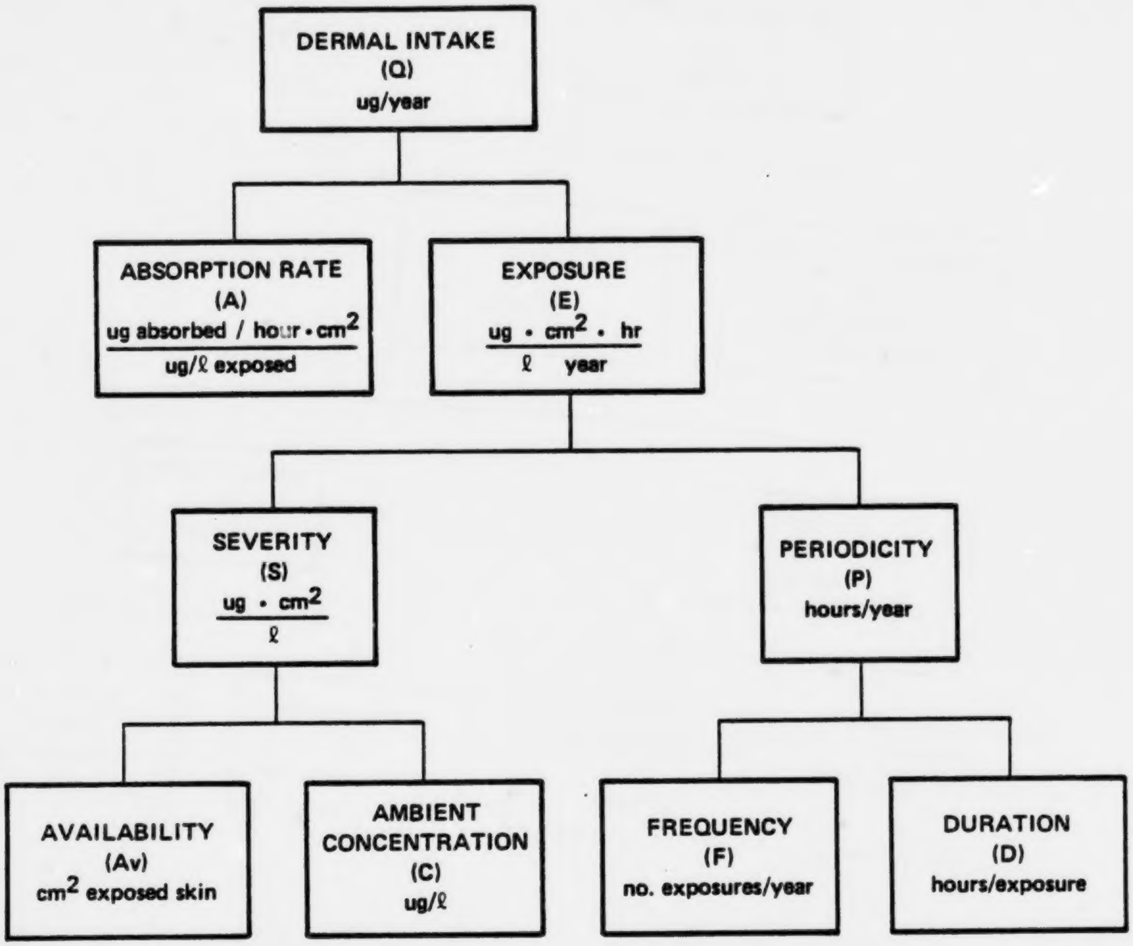

DERMAL INTAKE
(Q)
ug/year
ABSORPTION RATE
(A)
ug absorbed / hour • cm2 / ug/ℓ exposed
EXPOSURE
(E)
ug • cm2 • hr / ℓ year
SEVERITY
(S)
ug • cm2 / ℓ
PERIODICITY
(P)
hours/year
AVAILABILITY
(Av)
cm2 exposed skin
AMBIENT CONCENTRATION
(C)
ug/ℓ
FREQUENCY
(F)
no. exposures/year
DURATION
(D)
hours/exposure

FIGURE 3. EXPOSURE FRAMEWORK: DERMAL ROUTE

amount of dermal surface area available for exposure for the activities that result in dermal exposure.

The following mathematical relationships apply:

$S = C \times Av$
$E = S \times F \times D$
$Q = E \times A$

As with inhalation, an absorption rate (A) must be factored in to convert the exposure value (E) to a dosage. Methods for calculating A are not included in this report; the reader is referred to Scow et al. (1979) for stochastic algorithms.

1.3.3 Exposure of Aquatic Biota

Exposure to aquatic biota is usually expressed in terms of aqueous concentration of the toxic substance. Because the biota are continuously exposed over their entire body surface, the availability parameter that pertains to human dermal exposure is not usually considered. Also, unless the variations in concentration are known (a function of the periodicity of releases from the source(s)), the frequency and duration terms are usually neglected and exposure is keyed to the concentrations that occur at mean, median, or low flows.

2. SOURCES

The preliminary steps of this process involve gathering information needed to estimate the factor C, ambient concentration. This section and the following section (3.0) will discuss the assembly of relevant background data.

Source analysis in general provides a list of producers, their production volumes, and releases to the environmental media. This information can be generated by any of three complementary processes:

- Analysis of monitoring data
- Performance of a materials balance
- Use of estimating factors

The use of monitoring data is discussed in Section 4. The methods for performing materials balances are described in JRB (1981). Estimating factors are discussed in Sections 6.2.3(3) and 6.3.3(3).

The product of this section is a list of producers, their production volumes, and their geographic locations. Annual production values provide an indication of the amount of the chemical available for exposure and provide a starting point for performing a materials balance or using emission factors to estimate releases. This information is used later to generate ambient concentrations. Geographic locations of the producers are important because they identify the points of release from production. Ambient concentrations are often greatest in the immediate area of production. For the organic chemicals industry, which is anticipated to be the major industry of concern, 65 percent of all production occurs in Louisiana and Texas (ITE 1980).

Table 1 presents references, including data bases, that can be used to determine producers, production volumes, and their manufacturing locations. Comments on the variety of chemicals covered and ease of use are provided in the table. Generally, the information is stored under the chemical name. Because of changing economic conditions, plant shutdowns, and new plant construction, the most recent editions are needed to provide medium to high confidence in production volumes and locations. Companies view their production as confidential information; therefore, most sources list plant capacities rather than their production volume. If capacities are given, a general rule of thumb is to multiply the capacity by 80 percent to obtain the production volume. This 80 percent factor varies depending on economic conditions; an up-to-date factor can be obtained by referring to the chemical process industry output index published monthly in the periodical "Chemical Engineering."

Table 1. Sources of Information for Production Volumes and Geographic Location of Manufacturers

Sources of Information	Production volume	Geographic location	Comments
I. Reference Journals Government Agency Publications			
Directory of Chemical Producers (SRI 1981)	x	x	Good source, lists plant capacities instead of production for 10,000 chemicals with production >5,000 lbs or sales >$5,000.
Chemical Economics Handbood (SRI 1980)	x	x	Very good source; contains materials balances.
Production and Sales Statistics (USITC 1981)	x		Good source; lists producers that produce >5,000 lbs/yr or >$5,000 of sales.
Minerals Yearbook (Bureau of Mines 1981)		x	Good source for production and use patterns of minerals.
Minerals Inventory Surveys (Bureau of Mines 1981)		x	Good source for production and use patterns of minerals.
Mineral Commodity Profiles (Bureau of Mines 1981)		x	Good source for production and use patterns of minerals.
Consumption of Plastics (Modern Plastics; Jan. issue)			Good source for plastics production and use patterns.
Consumption of Plastics Additives (Modern Plastics; Sept. issue)			Good source for plastics additives production and use patterns.
Chemical Marketing Reporter (Chemical Marketing Journals)	x	x	Must search for appropriate issue and journals (use DIALOG).
Thomas Register of American Manufacturers (Thomas Register 1981)		x	Lists producers and locations of a wide variety of chemicals.

Table 1. Sources of Information for Production Volumes and Geographic Location of Manufacturers (continued)

Sources of Information	Production volume	Geographic location	Comments
Kline Guide-Industrial Marketing (Kline 1978)		x	Industries covered are: chemical, paper, plastics, paint and packaging; additional data on use patterns and process descriptions are provided.
Chemical Product Synopsis (Mannsville Chemical 1976)	x	x	Lists capacities, productin, imports, exports, and uses. Estimates provided are based on 1975 data.
II. Buyers Guides			
Chem Sources-USA (Chem Sources 1980)		x	No production values; covers 90,500 chemicals.
Aldrich Catalog Handbood of Organic and Biochemicals (Aldrich 1980)		x	No production values; covers 8,500 chemicals.
Chemical Week-Buyers Guide Issue (Chemical Week 1980)		x	No production values.
OPD Chemical Buyers Directory (Chemical Marketing Reporter 1980b)		x	No production values; covers 15,000 chemicals.
III. Data Bases			
PTS PROMPT Predicasts Overview of Market and Technology	x	x	Access by DIALOG online; good source for end uses, capacities, new products, and foreign trade.
PTS Funk and Scott Indexes	x	x	Subset of PTS PROMPT, access by DIALOG, forecasts of sales.
Radian-EPA Organic Chemicals Producers' Data Base		x	Good source; additional data on use patterns and release during production.

Table 1. Sources of Information for Production Volumes and Geographic Location of Manufacturers (continued) ..

Sources of Information	Production volume	Geographic location	Comments
IPC Chemical Production Data	x	x	Production, imports, and exports.
MEDLARS/TDB Toxicology Data Bank	x	x	Production, imports, and exports for 3600 chemicals; easy access.
CICIS (Chemicals in Commerce Information Service)	x	x	Production values and imports based on 1977 data and growth rates; easy access; covers 55,000 chemicals.
CPSC CHEMRIC	x	x	Can be accessed by phone.
DIALOG Searches	x	x	Bibliographic searches to rticles which have specific information on chemicals.
CIN (Chemical Industry Notes)	x	x	Access by DIALOG on line, contains production, sales, products and processes.

With regard to the data bases presented in the last section of the table, selection of the most useful data source can usually be based on the following priority scheme:

1 - Organic Chemicals Producers' Data Base
2 - CICIS
3 - CPSC CHEMRIC
4 - IPC Chemical Production Data
5 - TDB
6 - DIALOG (PTS, CIN, and Bibliographic Searches).

3. ENVIRONMENTAL PATHWAYS

3.1 Physicochemical Properties

It is necessary to know the environmental partitioning and fate processes specific to a chemical substance in order to predict its environmental concentration, as well as extent and duration of exposure. To determine this, one needs to know the physicochemical properties of the substance. In addition, the particle size of airborne pollutants affects the magnitude of exposure via inhalation. The output of this section will be necessary physicochemical parameters, with emphasis on gathering data for the ENPART model (see Section 3.2.2).

3.1.1 General Properties

The critical physicochemical data required for determining environmental partitioning and fate are vapor pressure, solubility, and Henry's law constant. The last can be estimated from the first two properties if its value is not available (GSC 1982). In addition, values for the following properties can aid in the determination of exposure pathways: molecular weight, phase at ambient conditions, density, boiling point, melting point, acid dissociation constant (pKa), vapor density, octanol/water partition coefficient, organic carbon/water partition coefficient, and reactive half-lives.

Table 2 provides a list of sources of information for the physicochemical properties mentioned above. The final entry listed is a group of estimation techniques (ADL 1981) accessible through the Graphical Exposure Modeling System (GEMS) maintained by EPA/OTS. These estimation programs are extremely valuable for evaluating new chemicals or for use where properties of existing chemicals are unavailable. The programs that are available as of this writing include the estimation procedures for octanol/water partition coefficient, aqueous solubility, activity coefficient, boiling point, and vapor pressure.

A molecular structure program, or S File, is also available for computer analysis of chemical structure. The input of the chemical structure into the S File is usually preliminary to the other estimation programs. Additional estimation programs that will more fully complement fate analysis (discussed later in this volume) are also available through the EPA-OTS Graphical Exposure Modeling System. These programs include soil adsorption coefficient, bioconcentration factor, volatility, tropospheric lifetime, stratospheric ozone depletion, hydroxyl radical oxidation, and ozone oxidation.

Table 2. Sources of Information for Physical/Chemical Properties

Reference	Data Provided											Comments
	Molecular weight	Physical state at 25°C	Density	Boiling point	Melting point	Vapor pressure	Solubility	pK_a	Vapor density	Log P	Half-life	
CRC Handbook of Chemistry and Physics (Weast 1977)	x	x	x	x	x	x	x		x			Good source for general properties of a large variety of chemicals.
Perry's Handbook for Chemical Engineers (Perry & Chilton 1973)	x	x	x	x	x	x	x		x			Good source for general properties of a large variety of chemicals.
Merck Index, (Windholtz 1976)	x	x	x	x	x		x					Good source for medicinal chemicals.
Faith, Keyes, and Clark Industrial Chemicals (Lowenhelm and Moran 1975)	x	x	x	x	x		x					Relatively small number of chemicals discussed.
Farm Chemicals Handbook (Meister Publishing Co. 1965-1981)	x	x	x	x	x		x					Good source for farm chemicals.
Lange's Handbook of Chemistry (Dean 1973)	x	x	x	x	x		x					Covers a variety of chemicals.

Table 2. Sources of Information for Physical/Chemical Properties (continued)

Reference	Data Provided											Comments
	Molecular weight	Physical state at 25°C	Density	Boiling point	Melting point	Vapor pressure	Solubility	pK_a	Vapor density	Log P	Half-life	
The Aldrich Catalog Handbook Organic & Biochemicals (Aldrich Chemical Co., Inc. 1980)	x	x	x	x	x							Covers many common and obscure organic chemicals.
Handbook of Environmental Data on Organic Chemicals (Verschueren 1977)	x	x	x	x	x	x	x					Covers many organic chemicals of environmental interest.
Water-Related Environmental Fate of 129 Priority Pollutants (Callahan et al. 1979)	x	x	x	x	x	x	x	x	x	x	x	Only 129 priority pollutants.
Environmental Fate Data Base (Syracuse Research Corp.)	x	x	x	x	x	x	x	x	x	x	x	Computerized file searchable by Chem Abstracts Number. Contains lab- and field-measured values and bibliographic sources. Currently accessible via OTS SPHERE system.

Table 2. Sources of Information for Physical/Chemical Properties (continued)

Reference	Data Provided											Comments
	Molecular weight	Physical state at 25°C	Density	Boiling point	Melting point	Vapor pressure	Solubility	pK_a	Vapor density	Log P	Half-life	
Substituent Constants for Correlation Analysis in Chemistry and Biology (Hansch and Leo 1979)										x		Good source for partition coefficients; also derivation of log P estimation techniques.
Specialty Literature Search on Computer (DIALOG)						x	x	x	x	x	x	Use before calculating by estimation techniques.
Physical/Chemical Properties Estimation Techniques (ADL 1981)				x		x	x			x		Use when published data are not available.

3.1.2 Particle Size Analysis for Airborne Pollutants

If the chemical is known to be an airborne contaminant in the Ambient environment, determining the size of any airborne particles allows a more accurate assessment of exposure via inhalation (Section 6.2). This is described more completely in the method outlined below.

- Classify the pollutant by contaminant type (gas, vapor, dust, fume, or mist) as defined in Table 3. This classification is based largely on specific information about how the pollutant is formed (e.g., combustion) and released, and on some of its physicochemical properties.
- Associated particle size ranges can be inferred from Table 3. If a more accurate, pollutant-specific particle size classification is available (perhaps from field analysis or the literature), it should be used in lieu of Table 3.
- When calculating exposure via the inhalation route, the extent of actual particle deposition in lungs (or pollutant brought to the body boundary), can be estimated, at least qualitatively, by the relationships defined in Figure 4. This figure shows that when the particle size range exceeds 5.0 microns, pulmonary deposition will be greatly reduced regardless of the quantity or concentration of the contaminant in the atmosphere. This should be reflected in the exposure figure when exposure via inhalation is being assessed (Section 6.2). Particles deposited in the upper respiratory tract are subject to ingestion.

Particle size also affects atmospheric transport and is a required input for some air models.

3.2 Partitioning

The extent and severity of ambient exposures to a toxic substance depend largely upon the partitioning of the substance in the environment. Partitioning refers to the relative distribution of a substance among environmental compartments (e.g., air, surface water, sediment, biota, soil). Partitioning can be evaluated by three basic procedures: (1) analogy with other compounds, (2) mathematical modeling, or (3) empirical methods. These are briefly reviewed below.

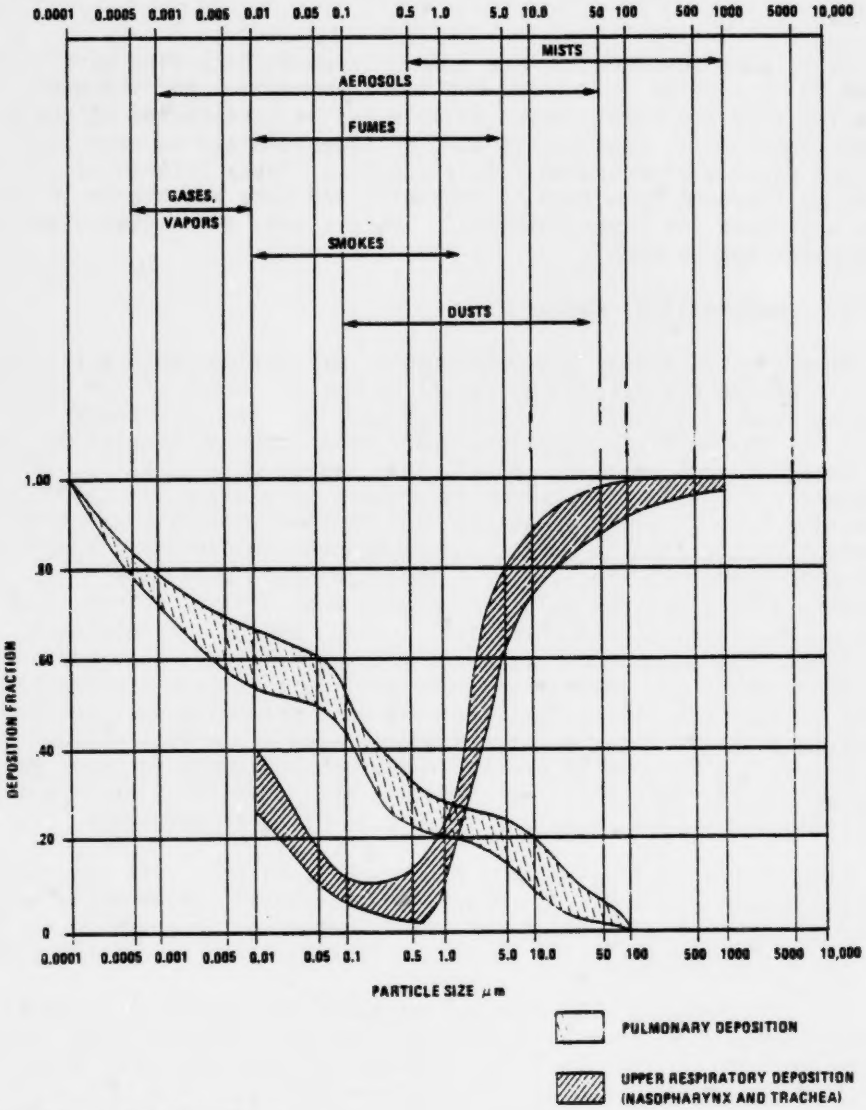
3.2.1 Analogy with Other Compounds

Existing models and empirical methods have been used for numerous classes of compounds (most commonly, the 129 priority pollutants). If

Table 3. Definitions of Atmospheric Contaminants

Contaminant	Definition	Size range (um)
Gas	Formless fluids occupying space that can be changed to the liquid or solid state by increased pressure and decreased temperature.	Molecular
Vapor	Volatile form of substances normally in the liquid or or solid state at normal temperature and pressure.	Molecular
Dust	Airborne solid particles, generated by phisical processes such as handling, curshing, or grinding of solids.	0.1-25
Fume	Solid particles generated by condensation from the gaseous state, generally after volatilization from the molten state. Formation often accompanied by oxidation or other chemical reaction.	0.01-5
Mist	Suspended liquid droplets generated by condensation from the gaseous to the liquid state or by dispersion of a liquid.	0.5-1000
Smoke	The result of incomplete combustion of carbonaceous materials, normally consists of carbon or soot particles. Particles can be wet and/or dry (e.g., tobacco smoke).	0.01-1.0
Aerosols	More of a comprehensive term, consists of liquid droplets or solid particles of fine enough particle size to remain dispersed in the air for a prolonged period of time.	0.001-50

Sources: Leidel et al. 1977; NSC 1979.



SOURCES: LEIDEL ET AL. 1977
SILVERMAN ET AL. 1971
BECKER ET AL. 1979

FIGURE 4. DEPOSITION OF ATMOSPHERIC POLLUTANTS IN THE BODY

the chemical under study is structurally similar to a previously studied chemical, some parallels can be drawn to the environmental fate of the analog.

It is also possible to make some inferences regarding partitioning based on inspection of process and transport data. For instance, organics that are highly water-soluble may be partitioned strongly in the water compartment, tend not to sorb or bioaccumulate to very high levels, and are usually biodegraded fairly rapidly. These inferences should be based on thorough knowledge of chemistry and some experience in reviewing fate processes for other chemicals. Uncertainty associated with these inferences can be high.

3.2.2 Mathematical Models

Mathematical models are based on the assumption that partitioning and transformation are determined by the sum of the rates of the individual chemical and biological processes and physical transfer mechanisms that occur for the specific substance under environmental conditions (Baughman and Lassiter 1978, Callahan et al. 1979, Mabey et al. 1981). In mathematical models (also known as process or evaluative models), the objective is to provide behavioral information characteristics of the chemical rather than to predict exact concentrations for a specific medium in a specific location. Examples of such behavioral characteristics are the relative amounts that will partition into each medium, the relative concentrations in each medium, the dominant reactions, the overall persistence, and the principal intermedia transport processes (Mackay and Paterson 1981). These are exactly the types of characteristics that are needed to determine what the principal exposure pathways might be; furthermore, because various estimation techniques can be used to provide required input data for such models, they can be employed for predicting the environmental fate of new chemicals, as well as existing, previously studied chemicals.

Several mathematical models have been developed. The leading multimedia mathematical model is ENPART (ENvironmental PARTitioning model), developed by OTS using the theoretical foundation proposed by Dr. D. Mackay of the University of Toronto. This model is described below.

(1) Background. The theoretical basis for ENPART is a series of relationships developed by Mackay and coworkers (Mackay 1979; Mackay and Paterson 1981), which, in turn, is rooted in the concept of fugacity. The following discussion is a very brief summary; for a full exposition, see the above cited articles by Mackay and the ENPART model documentation (GSC 1981).

Fugacity is a concept used to describe the equilibrium among environmental phases (e.g., water, air, biota, soil) and can be viewed as the "escaping tendency" that a chemical exerts from any given phase. At equilibrium, the "escaping tendency" (viz., fugacity) from one phase is equal to that from the other(s), so that the net rate of exchange among the phases is zero (Mackay and Paterson 1981).

Fugacity has units of pressure (Pa) and can be related to concentration by the expression:

$$C = Zf,$$

where C = concentration (mol m^{-3}),
Z = fugacity capacity constant (mol $m^{-3}Pa^{-1}$),
and f = fugacity (Pa).

The term Z is unique for each phase and each chemical. At equilibrium, f is equal for all phases; therefore, the relative concentrations in different phases are directly proportional to the ratios of their Z terms. Stated mathematically, if

$$f_1 = f_2, \text{ then}$$
$$C_1/Z_1 = C_2/Z_2, \text{ or}$$
$$C_1/C_2 = Z_1/Z_2.$$

The ratio C_1/C_2 (Z_1,/Z_2) is referred to as a "partition coefficient."

Values of f and Z for various phases can be calculated from basic physicochemical properties of the chemical. These calculation routines have been programmed into ENPART to allow estimation for Z in the atmosphere, surface water, soil, sediment (suspended and bottom), and aquatic biota. In cases where the necessary physicochemical property data are not available, estimation techniques can be used to predict basic properties (ADL 1981). The ENPART model already incorporates some of these predictive methods and is currently being improved by the addition of several new methods.

So far, the discussion has been limited to the basis for predicting the relations between equilibrium concentrations. Assumptions of equilibrium are inappropriate, however, if the reactions involved are kinetically hindered (especially if reaction rates are slow with respect to input rates (Pankow and Morgan 1981a, 1981b)). To address the importance of kinetics, ENPART can also be used in a dynamic mode.

Dynamic partitioning requires knowledge of interphase transfer rates as well as rates of degradation within each phase. Currently, the degradation processes that can be modeled are (GSC 1981):

Air compartment

Photolysis
Oxidation by hydroxyl radical
Oxidation by ozone
Loss to the stratosphere*.

Water compartment

Photolysis
Hydrolysis
Biodegradation.

Soil compartment

Hydrolysis
Biodegradation.

Some of the rates for these processes can also be estimated. Using rate data, the relative concentrations in a given phase can be estimated for any time after initial introduction of the chemical into the model environment.

Finally, the ENPART model can be used to predict not only relative concentrations in each phase, but also relative mass distributions in each phase. If compartment volumes are known, it is possible to convert the equilibrium concentration ratios into mass ratios. The ENPART model has a default definition of the environment from which a standard set of compartment sizes can be selected. The default compartment volumes in ENPART were chosen as reasonable volumes for air, water, soil, and sediment in which equilibrium could be expected to occur rapidly. Default volumes have been set as follows (GSC 1981):

Phase	Volume (m^3)
Air	$1.0 \times 10^{+4}$
Water	7.0
Soil	9.0×10^{-3}
Bottom sediment	2.1×10^{-2}
Suspended sediment	1.3×10^{-5}
Biota	3.5×10^{-6}

Associated default values for the density of each phase are also supplied by the model. The use of these volumes permits evaluation of the major sinks of a chemical that would be difficult to analyze on the basis of concentration alone. For instance, Mackay and Paterson (1981) perform an example calculation for a hypothetical compound in which the highest relative concentration is in biota ($Z = 63 \text{ mol/m}^3 \cdot \text{Pa}$) and the lowest relative concentration is in air ($Z = 4.0 \times 10^{-4} \text{ mol/m}^3 \cdot \text{Pa}$). Yet in terms of overall mass distribution, 55 percent of the compound resides in air and only 0.003 percent is bioaccumulated.

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*Not an actual degradation process, but considered as such because there is no stratosphere compartment in the model.

The theoretical basis of ENPART thus allows two classes of information to be deduced from data on physicochemical properties: relative (not absolute) concentrations in various environmental phases or compartments, and distribution of mass among the different phases. In fact, ENPART can qualitatively rank the environmental media as being of high, medium, or low importance, depending on the fraction of total material discharged or partitioned into each medium (GSC 1981).

Advective processes (i.e., transport) are not currently incorporated into ENPART. These processes may dominate the distribution of chemicals in the "real" environment. Calculations of systems with and without advection demonstrate the dominance of advection; Mackay and Paterson (1981) conclude that this dominance "...results in a fundamental difficulty in identifying and quantifying environmental processes by measurements of actual environments."

These processes limit the application of ENPART to a generalized environmental situation, but this is perfectly suited to a general assessment of environmental fate for identifying exposure pathways. The dependency of ENPART on readily available or estimable properties allows its use for either existing, previously studied chemicals or new (PMN) chemicals. Furthermore, the model can be used to perform sensitivity analyses to identify gaps in existing data or to indicate the compartments that should be designated for further testing (GSC 1981).

(2) Required inputs. Three types of input data are required for ENPART (Hall et al. 1981):

1. Emissions to air, water, and soil (mass/year, or percent of total emissions to each medium).
2. Environmental characteristics (ambient temperature, volume of each compartment, density of each compartment).
3. Physicochemical properties (e.g., Henry's law constant, vapor pressure, water solubility).

The first type of data is generated by a mass balance, monitoring data, or emission factors. The second type can be specified; alternatively, the model can provide default values. The minimum physicochemical data required for a simulation of equilibrium conditions are aqueous solubility, vapor pressure, octanol/water partition coefficient, and organic carbon/water partition coefficient. Of these, the model includes routines to estimate all but aqueous solubility. For a dynamic simulation, degradation and intermedia transfer rates are also needed. The model can estimate atmospheric and aquatic photolysis rates if an ultraviolet-visible absorption spectrum is input. Default values are available for the remaining rates; these are derived such that results of dynamic simulation will equal those for an equilibrium simulation if no rates are specified (i.e., degradation rates << transfer rates) (GSC 1981).

(3) Information resources. General information resources that provide physicochemical data are listed in Table 2 (Section 3). In addition, there are several notable sources for environmental process data. The 129 consent decree priority pollutants are examined in detail by Callahan et al. (1979). This information is supplemented by further measurement and estimation of process rates by Mabey et al. (1981). For chemicals other than the priority pollutants, available information is generally minimal. Hoffman (1981) and Pankow and Morgan (1981a, 1981b) summarize kinetic data for a number of reactions. Verschueren (1977) and the Environmental Fate Data Base, mentioned in Table 2, deserve special consideration as general sources for a number of chemicals.

Literature searches for specific chemicals may also yield primary or review articles concerning specific compounds. Consulting Chemical Abstracts or using an automated system such as DIALOG are both effective starting points.

3.2.3 Empirical Methods

Empirical methods involve the actual measurement of a chemical in various environmental compartments. Although these methods are accurate and can cut through the perplexing maze of variables and interactions that control environmental fate in a given situation, they are resource-intensive, require careful design and execution, and can make it difficult to trace exposures back to "controllable" sources. Furthermore, it may be difficult to extrapolate their results to other environmental situations.

Microcosms are the leading empirical method. A microcosm consists of a miniature ecosystem, typically including air, soil, water, rooted plants, aquatic plants, and aquatic organisms. Normally, a measured amount of chemical is introduced into the microcosm and samples of each compartment are analyzed periodically to determine partitioning. Persistence of the chemical in the various compartments can be determined if the experiment is of adequate duration. The rapidity with which the system approaches equilibrium can also be observed. This approach has proved to be quite useful, but only a few chemicals have been tested using microcosms.

A second empirical method is to measure chemicals in the ambient environment. The major drawbacks to this approach are the large numbers of samples that must be taken and the difficulty of establishing any cause and effect relationships that can be generalized to other locations. Mackay and Paterson (1981) emphasize the importance of advection (transport) in determining environmental concentrations; the great variability in transport from one location to another obscures the operative partitioning and transformation processes. Furthermore, the logistics and sampling design necessary to orchestrate a coordinated study in a "real" environment make such studies ponderous and impractical for general use.

Empirical studies are available for a limited number of compounds. No known compilations of compounds have been found, so it appears that the most practical way of determining whether an empirical analysis has been done for a specific toxic substance is to perform a literature search for that particular substance.

3.3 Environmental Pathway Models

Environmental pathway modeling is a key requirement for assessing exposure. Its function is to predict concentrations of chemical substances at the point where receptor populations are ultimately exposed. Examples of relevant models, are those used by the Exposure Evaluation Division (EED) of OTS serviced through their Graphical Exposure Modeling System (GEMS). Some of the components of this system include:

- An environmental partitioning model (ENPART, described in Section 3.2.2).
- Atmospheric models including the Atmospheric Box Model, ATM, PTMAX, and PTDIS. The last two are used to estimate ambient ground level concentrations and are part of the UNAMAP series discussed in Section 6.2.3.
- EXAMS, the water transport model described in Section 6.3.3.
- SESOIL, the Seasonal Soil Compartment Model. SESOIL estimates the rate of chemical mass transfer (loading) from soil surface to surface water and groundwater, soil concentration available for plant uptake, and volatilization rate from soil to atmosphere. SESOIL if further described and demonstrated in other more

appropriate parts of this report (Sections 3 and 5 of Volume 3 (Disposal) and Section 4 of Volume 5 (Drinking Water)).

Environmental pathway models, other than those used by OTS, are only listed and referenced in this document; see Section 6.2.3(1) for ambient air models, and Section 6.3.3(1) for ambient (surface) water modeling.

4. MONITORING DATA

When available, monitoring data are a useful information resource for determining ambient concentrations and environmental release rates. Areas where these data are useful in concentration estimation are noted in Sections 6.2.3 and 6.3.3. This section highlights the major data bases containing four classes of monitoring data: source, ambient, background, and personal monitoring. The section concludes with a summary of analytical techniques suitable for the detection of particular toxic substances in ambient water or air.

4.1 Source

Source monitoring is designed to characterize pollutant concentrations at the point of release to the environment, e.g., at a stack or outfall. This type of monitoring differs from ambient monitoring (see Section 4.2) in that (1) the pollutant concentration is directly attributable to a source, (2) detailed source monitoring will reflect pollutant loading to the environment, and (3) the pollutant concentration will be relatively high since it will disperse, dilute, and degrade before it is detected in "ambient monitoring".

The two types of releases of most concern in ambient exposure assessment are (1) emissions released to the atmospheric compartment and (2) effluents released to the aquatic compartment. Examples of air emissions include gases, vapors, mists, aerosols, smoke, fumes, and dusts. Liquid effluents include those discharges from industrial processes and publicly owned treatment works (POTWs).

The majority of source monitoring data is concerned with industrial sources. The available data bases and information sources are organized to parallel the legislative mandates for monitoring, which are by environmental medium (air, water).

4.1.1 Air Emissions

Sources that release pollutants to the atmosphere fall into three types: point, area, and line (or mobile). Major specific point sources consist of individually identified sources (e.g., stacks). Such sources have known locations and modes and rates of emission. Area sources usually consist of sources that are numerous, small, or of uncertain location, and yet produce isolated patterns of significant concentration. Concentration patterns from area sources are analyzed cumulatively rather than individually. Line or mobile sources include all modes of transportation. These sources are also numerous and distribute their emissions throughout transportation corridors. Transportation modes include automobiles, other road vehicles, aircraft, ships, and trains.

Data bases concerned with point source discharge data that should be investigated include the Aerometric Emission Reporting System (AEROS) and its subsets; the Environmental Assessment Data Systems (EADS) and its subsets; and the Compliance Data System (CDS). These data bases contain the majority, if not all, of the computerized point source discharge data available. Area source and line source discharge data are not as easily accessible as point source discharge data. Data bases covering area source emissions include the National Emissions Data System (NEDS), the Hazardous and Trace Emissions System (HATREMS), and the Emission Inventory Subsystem/Permits and Registration Data System (EIS/P&R), all of which are subsets of AEROS. With regard to data base priority, NEDS should be consulted first and EIS/P&R last, based on existing capabilities. Data bases concerned with line or mobile source emissions include the Emission Factor-Mobile Sources System and HATREMS.

AEROS consists of several subsystems, of which only a few are relevant to industrial source discharge data (most pertain to ambient data). Based on existing capabilities, priority should be given to the NEDS retrieval for the most comprehensive data coverage. NEDS contains point source and area source data dating back to 1972. Pollutants include hydrocarbons and volatile organic compounds, but the vast majority of data are on the "criteria" air pollutants -- particulates, sulfur dioxide, nitrogen oxides, carbon monoxide, total hydrocarbons, and ozone. Nonpollutant parameters include flow rate, production level, stack parameter codes, temperature, treatment, and design rate. Samples of NEDS data base outputs are provided in Appendix C, Exhibits C.1-6, C.2-6, and C.3-6.

HATREMS is operated in parallel with NEDS as a subsystem of AEROS. HATREMS stores data collected regarding emissions of air pollutants that are not included in NEDS, i.e., other than the criteria pollutants. As of this writing, lead and VOC are the only parameters covered by this data base. HATREMS will list, according to counties, all point source industrial air emitters, including facility name, address, and location coordinates; provide operating characteristics of the facility (e.g., stack height, exit velocity); and, where monitoring data are available, quantify on an annual basis the total estimated emissions (tons/year) for the pollutant of interest. Samples of the HATREMS data base outputs are provided in Appendix C, Exhibits C.4-1 and C.4-2.

HATREMS quantifies on a county basis the annual area source emissions (tons/year) from the following sources:

- Residential fuel combustion (coal and oil)
- Industrial fuel combustion (coal and oil)

- Residential on-site incineration
- Commercial-institutional on-site incineration
- Industrial on-site incineration

It also provides annual area source emissions (tons/year) from the following vehicular sources:

- Light duty vehicles
- Heavy duty vehicles
- Off-highway vehicles

HATREMS retrievals can be requested by contacting EPA-OAQPS in Research Triangle Park, North Carolina, (Mr. Harold Barkau (919) 541-5882 or Mr. Jake Summers (919) 541-5495).

State air quality control board inventories are a secondary source of site-specific point-source emissions data. In theory, the data contained in state inventories should be the same as the information contained in HATREMS since HATREMS relies on information collected by the states. However, state data may actually be more complete, accurate, and up-to-date than HATREMS because data may be lost in transmission and because there is a lag time between receipt of the state data by EPA-OAQPS and entry into HATREMS. A problem with state inventories is that many are not computerized and access to the information is time consuming, frequently requiring a site visit to the state air control board office. Another disadvantage of the state inventories with respect to HATREMS is that they contain no generic information to permit estimation of annual emissions where site-specific monitoring data are lacking. This is particularly important with regard to the noncriteria pollutants such as toxics.

EIS/P&R contains point and area source emissions data and is similar to NEDS. This system is for state and local use to fulfill their emissions reporting requirements. Nonpollutant parameters include discharge points, flow rates, production levels, volume/mass measures, and treatment.

The Source Test Data System (SOTDAT) contains point source stack emissions data from as far back as 1967. The data are limited to source test data for selected facilities. Pollutant and nonpollutant parameters are the same as those contained in NEDS. Products from AEROS include computer printout retrievals and published reports. AEROS and its subsystems are maintained by OAQPS-RTP.

EADS consists of several subsystems based on physical characteristics of the emissions or the method by which data are gathered. They include the Fine Particle Emissions Information System (FPEIS); Gaseous Emissions Data System (GEDS); Liquid Effluent Data System (LEDS); Solids Discharge Data System (SDDS); Fugitive Emissions Information System (FEIS); and Continuous Monitoring Data System (CMDS). The first four subsystems are operational and undergo continuous upgrading. FEIS and CMDS are still in the design stages of development. These subsystems contain data and information characterizing the emissions and discharges of energy systems and industrial processes. Nonpollutant parameters include flow rates, treatment, volume/mass measures, discharge points, and test descriptions.

The basis of the EADS reporting structure is the Test Series, which describes the sampling activities performed at a single site over a specified period of time. Each Test Series is assigned a unique Test Series Number (TSN) which can always be used to identify those data. The report formats currently available include the Series report, which provides the complete contents of a Test Series; the Snapshot report yielding a concise two-page summary of each TSN; and an Abstract report, which will produce a statistical overview of the data provided in the other reports.

The Abstract reports are the EADS output most useful to the methods in this volume. Two abstract reports, a chemical statistics report (including a majority of organic pollutants), and a particle distribution summary, are included in Appendix C, Exhibit C.4-3. In addition, a Series report and a Snapshot report from FPEIS are supplied for the same TSN in Appendix C as Exhibits C.4-4 and C.4-5, respectively.

Currently, there are approximately 525 Test Series incorporated into EADS. The largest data bank is in FPEIS with about 260 Test Series (or sample sites), the smallest being SDDS with about 20. IERL-RTP, responsible for maintaining the system, reports that these numbers are growing with the system's continuous upgrading.

CDS is a management information system that contains data on plants, factories, and other stationary point sources of air pollution. Pollutants include hydrocarbons, vinyl chloride, and heavy metals. Nonpollutant parameters include compliance data, discharge points, and production levels. CDS is maintained by the USEPA Stationary Source Enforcement Division located at EPA headquarters.

For studies on air emissions, AEROS and CDS contain the most data and are the most comprehensive in their coverage; therefore, these two data bases should be investigated before other systems. EADS is relatively new and does not contain as much data at this time. Further descriptions of these and other relevant data bases can be found in Appendix A.

In many cases, the aforementioned data bases will not include data on a specific toxic chemical. Monitoring of toxics in air emissions has lagged behind monitoring in aqueous discharges because the regulatory focus has been on the criteria pollutants. National Emissions Standards for Hazardous Air Pollutants (NESHAPS), mandated under Section 112 of the Clean Air Act, have been developed for only five substances: asbestos, beryllium, mercury, vinyl chloride, and benzene. Therefore, the national computerized data bases often are of little help. Alternatives include state files (many states require release data for specific chemicals) and literature searches for articles and reports regarding the chemical of interest. Several files in the DIALOG and ORBIT search systems contain literature on environmental releases (these systems are also described in Appendix A).

4.1.2 Water Discharges

Sources that release pollutants to the aquatic compartment fall into two types: point and nonpoint. Point sources generally are described as those that discharge to a receiving stream through a discrete pipe or other conveyance. Nonpoint sources include urban runoff, agricultural and silvicultural runoff, and mining operation runoff.

Data bases concerned with point source discharge data that should be investigated include: Best Available Technology (BAT) Review Studies (industry specific); Data Collection Portfolios (industry specific); EADS; National Pollutant Discharge Elimination System (NPDES); and Permit Compliance Systems (PCS). These data bases contain the majority of point source discharge data available. Nonpoint source discharge data are not as prevalent. The Nationwide Urban Runoff Program (NURP) is the only major program with monitoring data on toxics.

The BAT Review Studies are industry-specific programs sponsored by the Effluent Guidelines Division (EGD) of USEPA. Pollutant parameters include the 129 consent decree priority pollutants. Nonpollutant parameters include discharge points, flow rates, production levels, and treatment. Industries addressed in these and other related studies include organic chemicals, plastics, pharmaceuticals, inorganic chemicals, paint, ink, steam electric, food, textiles, timber, and pulp and paper. These other related studies include screening/verification protocols, best management practices, and innovative technology profiles. Most of the specific plant data in these studies are confidential; however, industry-wide averages and ranges can be obtained from the development documents published from these studies.

The Data Collection Portfolios contain point source effluent data on an industry specific basis. Pollutants include conventional and priority pollutants. Nonpollutant parameters include discharge points, flow rates, production levels, treatment, and water usage. Measurement of waste volume and pollutant load per ton of finished product and applied waste disposal scheme and capability are also included in this EGD data base.

NPDES Compliance Files contain information relating to the compliance status of both industrial and municipal permit holders. Point source data collection dates back to 1974, and the resulting discharge monitoring reports are maintained on a state and regional basis. Monitored pollutants are dependent upon permit reporting requirements. Nonpollutant parameters include flow rates, production levels, discharge points, treatment, and volume/mass measurements.

PCS is similar to the NPDES file and is structured to compare effluent data and NPDES limits in order to identify violations. Discharge monitoring reports are the source of PCS data. Pollutant and nonpollutant parameters are the same as in NPDES.

Nonpoint source pollution data collected by NURP will be included in STORET. These data include atmospheric deposition and urban runoff data taken during storm events. Currently, 33 cities across the nation are contributing data to this program. Pollutants include the 129 consent decree priority pollutants. Nonpollutant parameters include flow rates, precipitation, and volume/mass measurements. NURP is managed by the Office of Water Programs Operations (OWPO).

For addressing water discharge data, the various EGD programs are the most comprehensive in their coverage and, along with NPDES and PCS, should be investigated before other systems. There can, however, be overlap in these closely related data bases. Further descriptions of these and other relevant data bases can be found in Appendix A.

Although considerably more data are available on specific toxics in water than on those in air, data on chemicals other than those for priority pollutants are rare. PCS includes a number of additional pollutants, but the other data bases do not. State data bases rarely include data on additional pollutants in aqueous discharges (unlike air emissions). Again, literature searches using DIALOG or other systems should be considered as alternatives or supplements to the above-mentioned data bases.

4.2 Ambient

The primary media of concern in the ambient environment are water, air, and soil/sediment. By far the majority of ambient monitoring data are from the aquatic and atmospheric compartments. Correspondingly, the majority of the data bases are concerned with these two media.

Two of the largest ambient monitoring data bases are the Storage and Retrieval of Aerometric Data (SAROAD) (a subsystem of AEROS), and the Storage and Retrieval of Water Quality and Related Data (STORET). These provide data on air quality and water quality, respectively, and both are maintained by EPA.

4.2.1 Air

SAROAD provides data on air pollution trends and conditions for use in regulatory programs. The data in SAROAD include concentrations of both criteria and noncriteria pollutants by site and time. Consequently, they have a limited application to these methods. Ambient air monitoring data in SAROAD date back to the late 1950s and cover all major cities and one third of U.S. counties. Currently, more than 14,000 monitoring stations are providing ambient air quality data, some on a daily basis. SAROAD contains an estimated 300 million observations. Further descriptions of SAROAD and other ambient air quality monitoring programs can be found in Appendix A.

4.2.2 Water

STORET contains data on samples taken from more than 680,000 unique collection points located on essentially all of the nation's rivers, lakes, streams, and other waterways. The 67 million plus individual observations, dating from the late 1950s, provide data on water quality in general but also include fish tissue, shellfish tissue, other aquatic organism tissue, and sediment samples. A subset of STORET, TOXET, includes some multi-media data on toxic chemicals (primarily water, sediment, and tissue). Parameter classes in STORET include physical data, metals, dissolved oxygen, general inorganics, general organics, oxygen demand, nitrogen, solids, bacteriological data, biological data, flow, pesticides, phosphorus, and radiological data.

Two water quality monitoring programs similar to STORET are maintained by USGS. The U.S. National Water Data Storage and Retrieval Systems (WATSTORE) and the National Stream Quality Accounting Network (NASQAN) both provide data on surface and groundwater quality. These two systems should be used to supplement a STORET retrieval. Further descriptions of STORET, WATSTORE, and NASQAN can be found in Appendix A.

In addition, the Soil, Water, and Estuarine Monitoring System (SWEMS) provides ambient data on soil, crop, and residue tissues. There are an estimated 12,500 observations from 9,000 stations in SWEMS nationwide.

Most of the data concern pesticide residues. At present, no other information has been identified concerning ambient soil monitoring programs. The Agricultural Research Service of USDA analyzes soil samples, but only for standard chemical and physical properties. USGS and STORET (EPA) have limited sediment sampling data from the aquatic compartment. In addition to the computerized data bases, there are numerous special studies on ambient media. A notable study on previously undetected toxic chemicals in ambient water was conducted by Ewing and Chian (1977). Studies on specific organics in ambient air were performed by Jarke (1979) and Brodzinsky and Singh (1982). Other reports on specific chemicals can be accessed by DIALOG, ORBIT, or other bibliographic search systems.

4.3 Background

Background monitoring measures pollutant concentrations in remote and usually uninhabited geographic areas (e.g., over oceans, in the wilderness, or near polar regions). These data represent naturally occurring pollutant levels and anthropogenic far-field concentration information where contributing sources are not identifiable. Background data are useful in exposure assessments of ubiquitous compounds (e.g., PCBs). Where modeled concentrations from a source(s) decreases with distance to the background level, exposures from that point out can no longer be attributed to the source. Also, if control strategies are to be developed, the effectiveness of reducing emissions from a single source or group of sources can be evaluated in terms of percent reduction in total exposure.

The following subsections discuss sources of background monitoring data for air and water.

4.3.1 Air

Data on background concentrations of toxics in air are available on a very limited basis from independent research projects and the SAROAD system.

A leading researcher in the field of background air monitoring is Dr. Paul Altshuller. Table 4 summarizes his research on background air concentrations of selected chemical species completed to date.

The Storage and Retrieval of Aerometric Data System (SAROAD), discussed in Subsection 4.2, also provides background levels for some of its constituent parameters. Code 03 - Background Surveillance is used with SAROAD to identify these specific retrievals. OAQPS/RTP/NC also maintains a Filter Bank Network which is primarily involved in gathering

Table 4. Average Concentrations of Chemical Species at Various Types of Sites (ug/m^3)

Species	South Pole	Over Oceans	Remote Continental South America	Remote Continental Northern Hemisphere	Rural U.S., Europe	Urban
Sulfate	0.15-0.25	0.9±0.5	0.35	0.5	3-15	5-25
Ammonium		$\lesssim$ .1		.35	2.5	2-10
Nitrate		<.005			.3-.5	1-12[a]
Lead	0.0006	.001	0.05	.01	.05-.15	0.5-5
Bromide	.0006	.003	.001-.004	.001-.005	.01-.06[b]	.1-2[b]
Arsenic			.001	.0002-.002	.01	
Selenium	.000006	.0001	.00004-.0003		.004	
Vanadium	~ .000001	.00001-.00005	.0002	.0002-.0017	.001-.05	.01-2
Carbon-Containing compounds		1.0		1.0		2-20

[a] May be too high owing to collection of nitric acid as well as particle nitrate.

[b] Estimates from the usual ranging of Br to Pb ratios.

Source: Altshuller 1982.

data from a number of public and private sources on trace metals and other airborne particulates. Filter analyses are performed at the RTP Laboratories.

NOAA's Geophysical Monitoring for the Climatic Change Program collects data from numerous stations, four of which are located in remote areas. Data available from these stations include information on:

- CO_2
- Ozone
- Condensation nuclei
- Atmospheric turbidity
- Precipitation chemistry
- CO
- Trace gases
- Fluorocarbons
- Nitrous oxides
- Trace elements

The contact for this program is: Dr. James Peterson, Air Resources Lab., Environmental Research Lab., NOAA: Boulder, Colorado, (303) 497-6290.

4.3.2 Water

Data for background concentrations of toxics in water are available through the National Hydrologic Benchmark Network, maintained by USGS. This network monitors 57 stations, all in remote or isolated environments, in 37 states across the United States. The network is stored within STORET (see Appendix A), and may be accessed by station number (see Table 5). Parametric coverage includes:

- Metals, run twice a year: arsenic, barium, cadmium, chromium, cobalt, copper, iron, lead, lithium, manganese, mercury, molybdenum, zinc, selenium, silver, strontium, and vanadium.
- Priority pollutants (very limited data).
- Radioactive isotopes - total alpha, beta counts, run once a year.
- Pesticides, run once a year.

A sample retrieval of this data base is included in Appendix C, Exhibit C.4-6.

4.4 Personal Monitoring

The term "personal monitoring" refers to the use of a portable sample collector that is carried by a volunteer. Currently, the state-of-the-art is limited to sampling air to enable calculation of

Table 5. National Hydrologic Bench-mark Network Monitoring Stations

Station	Storet #
Talkeetna River near Talkeetna, AK	15292700
Blackwater River near Bradley, AL	02369800
Sipsey Fork near Grayson, AL	02450250
Wet Bottom Creek near Childs, AZ	09508300
Cossatot River near Vandervoort, AR	07340300
North Sylamore Creek near Fifty Six, AR	07060710
Elder Creek near Branscomb, CA	11475560
Merced River at Happy Isles Bridge near Yosemite, CA	11264500
Halfmoon Creek near Malta, CO	07083000
Vallecito Creek near Bayfield, CO	09352900
Sopchoppy River near Sopchoppy, FL	02327100
Falling Creek near Juliette, GA	02212600
Tallulah River near Clayton, GA	02178400
Honolii Stream near Papaikou, HI	16717000
Hayden Creek below North Fork, near Hayden Lake, ID	12416000
B. Jacks Creek near Bruneau, ID	13169500
South Hogan Creek near Dillsboro, IN	03276700
Elk Creek near Decatur City, IA	06897950
Big Creek at Pollock, LA	07373000
Wild River at Gilead, ME	01054200
Washington Creek at Windigo, Isle Royale, MI	04001000
Kawishiwi River near Ely, MN	05124480
North Fork Whitewater River near Elba, MN	05376000
Cypress Creek near Janice, MS	02479155
Beauvais Creek near St. Xavier, MT	06288200
Swiftcurrent Creek at Many Glacier, MT	05014500
Dismal River near Thedford, NE	06775900
South Twin River near Round Mountain, NV	10249300
Steptoe Creek near Ely, NV	10244950
McDonalds Branch in Lebanon State Forest, NJ	01466500
Mogolion Creek near Cliff, NM	09430600
Rio Mora near Terrerro, NM	08377900
Esopus Creek at Shandaken, NY	01362198
Cataloochee Creek near Cataloochee, NC	03460000
Bear Den Creek near Mandaree, ND	06332515
Beaver Creek near Finley, ND	05064900
Upper Twin Creek at McGaw, OH	03237280
Blue Beaver Creek near Cache, OK	07311200

Table 5. National Hydrologic Bench-mark Network Monitoring Stations (continued)

Station	Storet #
Kiamichi River near Big Cedar, OK	07335700
Crater Lake near Crater Lake, OR	11492200
Minam River at Minam, OR	13331500
Young Womans Creek near Renovo, PA	01545600
Scape Ore Swamp near Bishopville, SC	02135300
Upper Three Runs near New Ellenton, SC	02197300
Castle Creek above Dearfield Reservoir, near Hill City, SD	06409000
Little Varmillion River near Salem, SD	06478540
Buffalo River near Flat Wood, TN	03604000
Little River above Townsend, TN	03497300
Limpia Creek above Fort Davis, TX	08431700
South Fork Rocky Creek near Briggs, TX	08103900
Red Butte Creek at Fort Douglas, near Salt Lake City, UT	10172200
Holiday Creek near Andersonville, VA	02038850
Andrews Creek near Mazama, WA	12447390
North Fork Quinault River near Amanda Park, WA	12039300
Popple River near Fence, WI	04063700
Cache Creek near Jackson, WY	13018300
Encampment River above Hog Park Creek, near Encampment, WY	06623800

Source: Cobb and Biesecker 1971.

inhalation exposures; dermal absorption is not covered. Personal monitoring has been most widely used in occupational settings but has recently been used to a limited extent to assess general population exposures. The monitoring data generated by these studies provide an integrated picture of exposure in all microenvironments through which the volunteers pass, as well as all of the exposure scenarios (i.e., ambient, consumer, occupational, etc.). The application of the results is therefore not restricted to the ambient scenario unless all of the sources and microenvironments pertain only to the ambient environment.

Although personal monitoring has not been widely used beyond the workplace, it is being rapidly developed because of a series of studies that have provided significant results: air quality measured at fixed station monitors is often not representative of the concentrations to which human populations are exposed. The influences of multiple sources and different microenvironments have been dramatically shown by these studies, at least for "conventional" air pollutants (e.g., particulates, CO). Thus, the current approach to air pollution regulation, which is generally based on outdoor ambient concentrations, is being reexamined, and the distinction between indoor environments of various types (e.g., residences, offices, energy-efficient buildings) and outdoor environments has been shown to be important.

Only a handful of studies have used personal monitors to characterize exposure to organic pollutants in the ambient environment; for the most part, it is difficult to separate the contribution of ambient sources from consumer or other types of sources in these studies. There is no computerized data base available to access the data, but most of the available information can be found in reports on the EPA-ORD Monitoring Methods Development in the Beaumont-Lake Charles Area, the EPA-ORD Total Exposure Assessment Methodology (TEAM) Study, the Harvard Medical School Six City Study, and the EPA-EED Halocarbon Study. Ott (1981) and coworkers have had notable success in developing an exposure model compatible with personal monitoring data, but they have limited their studies to carbon monoxide.

The EPA-ORD Beaumont - Lake Charles study (USEPA 1980a) was initiated in 1978 as a preliminary step to develop, demonstrate, and test methods for monitoring levels of chemicals, primarily in air and water, and to measure effects of the atmosphere on indicator organisms, all within a defined geographic area. Major areas of investigation in this study were collection of relevant background information, including geographical, climatological, and industrial production and discharge data; preliminary source investigations at selected major industries; and evaluation of new methods for detecting environmental agents and their corresponding biological effects. The following methods and systems were tested as part of the above activities: three methods for collecting organic gases in air; a massive air sampler (MAS) and subsequent Salmonella mutagenesis testing; a scheme for extraction and fractionating organic material collected by the MAS; methods for detecting direct atmospheric effects on mutation frequencies of Tradescantia and Zea mays; and methods for personal monitoring -- measuring levels of chemicals in individual air, breath, body fluids, and drinking water samples.

The TEAM Study (Pellizzari et al. 1982) is a two-phase research program to field test methodologies for estimating total human exposure to selected toxic or hazardous substances. The program objectives are: sampling and analysis of air and drinking water consumed by a sampled volunteer population; collection and analysis of breath, blood, milk, and urine; collection of information from participants regarding activities and possible exposures during the study period; statistical analysis of collected data; and continual monitoring of the study activities. The study attempts to establish for each substance the relative importance of certain routes of exposure and whether a predictable correlation exists between exposure and body burden.

The Harvard Six City Study is a developmental program to determine the basic logistics for personal monitoring studies in both the indoor and outdoor microenvironments. Measurements made by portable samplers carried by the subjects are correlated with the subjects' activities (that were concurrently recorded in a log) and with measurements taken at fixed stations both indoor and outdoor. Preliminary results show that if both outdoor and indoor concentrations are considered, 77 percent of the variance in recorded personal exposures can be explained; only 22 percent of the variance can be explained if only outdoor concentrations are considered. Information on the final report of this study can be obtained by contacting Dr. John Spengler, Harvard School of Public Health (Boston), 617-732-1255.

The EPA-EED Halocarbon study is in its preliminary stages and assesses halogenated hydrocarbon data as measured by fixed site air monitoring stations and personal ambient air samplers. Data are available for Greensboro, North Carolina, and Geismar, Louisiana. Initial analyses indicate that levels of compounds that were detected in both personal and fixed air samples were significantly higher in personal air. Also, personal air levels are more highly correlated with corresponding breath levels than are fixed site air levels.

4.5 Analytical Techniques

This section summarizes the analytical techniques used in the laboratory to quantify organic and inorganic pollutants associated with environmental monitoring. This information is included in this section to allow the analyst to evaluate the quality of his monitoring data based on the analytical techniques prescribed for a particular pollutant or class of pollutants. The techniques described herein consider contaminants in broad classes from all environmental media without regard for their sampling matrix or method of extraction. No distinction is made as to the pollutant's environmental origin because the same analytical technique is generally used regardless of whether the sample is aqueous or atmospheric. Sample preparation and extraction techniques are highly compound- and situation-specific and are not addressed here. The following information is based on federally approved procedures and analytical methods currently in practice.

4.5.1 Organics

Laboratory analysis of organics is achieved through separation, identification, and quantification of the individual compounds. Chromatographs are used to initially separate the sample into its constituent compounds, and detectors are used to identify and quantitate. Generally, two types of chromatographs are used: gas chromatographs for lighter, easily volatilized substances; and liquid chromatographs for heavier, less volatile substances. The wide variety of detectors which are currently used are specific to the type of compounds being analyzed and the carrier gases being used in the analysis. A summary of the more selective detection systems (used cooperatively with the appropriate chromatograph) is presented in Table 6.

Since regulation has focused attention on the analysis of organics from the USEPA's water priority pollutant list, additional information is available on specific techniques prescribed for the quantification of these compounds. This information is summarized in Table 7.

Recently, the use of the GC/Mass Spectrometer system has been found comparatively accurate and economical in analyzing the priority pollutants classified in Table 7. The MS detector is used to overcome interferences that would mask compound responses obtained with most other detection systems. EPA has proposed that the GC/MS system be considered as an option when analyzing 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD), volatile organic compounds that are amenable to the purge and trap method, and a number of organic compounds that are solvent-extractable and amenable to gas chromatography (USEPA 1979b).

4.5.2 Inorganics

There are two methods for quantification of trace metals in environmental samples: Atomic Absorption (AA), and inductively coupled plasma optical emission spectrometry (ICP). Currently, the ICP is more widely

Table 6. Summary of Chromatographic Detector Selectivity

Detector	Selectivity
Thermal conductivity	Universal - responds to all compounds.
Gas density balance	Universal - responds to all compounds whose MW differs from carrier gas.
Flame ionization	Responds to organic compounds, not to fixed gases or water.
Electron capture H^3 Ni^{63}	Response to electron adsorbing compounds, esp. halogens, nitrates, and conjugated carbonyls.
Alkali flame	Enhanced response to phosphorus or nitrogen compounds.
Helium	Universal - responds to all compounds.
Cross section	Universal - responds to all compounds.
Photoionization	Selectivity based upon ionization potential of compound.
Hall electrolyte conductivity	Halogen-specific or nitrogen-specific (depending on reactor conditions and electrolytic solution).
Nitrogen-Phosphorus	Nitrogen-specific or phosphorus-specific depending on combustion gas.
Mass spectrometry	Universal.

Sources: McNair and Bonelli 1968; Versar laboratory personnel.

Table 7. Analytical and Detection Systems for 114 Organic Priority Pollutants by Classes

EPA Method #	Parameter Class	Analytical System	Detection System
601-	Purgeable halocarbons	GC	Halide-specific.
602-	Purgeable aromatics	GC	Photoionization.
603-	Acrolein and acrylonitrile	GC	Differential flame ionization/ thermionic or Hall for just acrylonitrile.
604-	Phenols	GC	Flame ionization/electron capture.
605-	Benzidines	HPLC	Electrochemical.
606-	Phthalate esters	GC	Flame ionization/electron capture.
607-	Nitrosamines	GC	Nitrogen phosphorus/Hall.
608-	Organochlorine pesticides and PCBs	GC	Electron capture/halogen-specific.
609-	Nitroaromatics and isophorone	GC	Electron capture/flame ionization.
610-	Polynuclear aromatic hydrocarbons	HPLC	Fluorescence/UV.
611-	Haloethers	GC	Halide-specific.
612-	Chlorinated hydrocarbons	GC	Electron capture.

GC = Gas chromatograph.

HPLC = High pressure liqid chromatograph.

Source: USEPA 1979b.

used because it is less expensive, faster, and for some substances it offers better detection limits and repeatability than the AA method. Table 8 is a list of elements that can be analyzed by ICP.

Inorganics that require wet chemistry analyses use methods that are unique to the specific parameter. Documentation on these methods are found in Standard Methods for the Examination of Water and Wastewater (APHA 1975), and Methods of Chemical Analysis of Water and Waste (USEPA 1979c).

Table 8. Elements Analyzed by ICP.

Aluminum (Al)
Barium (Ba)
Beryllium (Be)
Boron (B)
Cadmium (Cd)
Calcium (Ca)
Chromium (Cr)
Cobalt (Co)
Copper (Cu)
Iron (Fe)
Lead (Pb)
Lithium (Li)
Magnesium (Mg)
Manganese (Mn)
Molybdenum (Mo)
Nickel (N)
Potassium (K)
Silver (Ag)
Sodium (Na)
Strontium (Sr)
Tin (Sn)
Titanium (Ti)
Vanadium (V)
Yttrium (Y)
Zinc (Zn)

5. EXPOSED POPULATIONS

Identification and quantification of the human population exposed to a chemical substance in the ambient environment represent major components of exposure profile development (outlined in Section 6). Identification relies on information produced earlier in the methodology: release from and distribution of the pollutant around sources, physicochemical characteristics of the toxic substance in the environment, and identification of the media and microenvironments in which the chemical will persist. Quantify cation and characterization of the exposed human populations, once identified, can be accomplished by the population enumeration techniques outlined in Volume 4 of this report. The present section will summarize the population methodology to indicate how it fits into the overall assessment.

Because populations exposed to chemical substances in the ambient environment are defined geographically, the Census of Population is the major data base. Population data are available down to the level of Block Group within Standard Metropolitan Statistical Areas (SMSAs), and are available down to the level of the Enumeration District in non-SMSAs.

Human populations to be analyzed are identified primarily by the geographic distribution of a pollutant and by the human activities associated with the primary exposure pathways. Information on the geographic distribution of a pollutant in the ambient environment will set an initial limit on the population potentially exposed.

The transport and transformation of a pollutant (discussed in Section 3) would also affect the geographic limits of population identification, as it would affect the associated exposure pathways.

Specific information on quantities, emission characteristics, and the physical phase in which a pollutant enters the ambient environment will focus the analysis to the microenvironments, media, and exposure routes (exposure pathways) that are relevant.

The computational techniques using the information on frequency, duration, and other activity-related aspects generated in this section are described in Section 6.

Enumeration of the population exposed to atmospheric pollutants emitted from point sources is by means of a computer modeling system (ATM-SECPOP) that integrates the output of the Atmospheric Transport Model (Section 6.2.3(1)), a population distribution data base, and graphic and mapping information displays. Volume 4 of this report provides all the details on the use and modifications of the model for point, area, and line source enumerations.

Dermal exposure to chemical substances in the ambient environment may occur through a number of pathways. Geographically-defined sources of aquatic exposure, such as river reaches downstream of an industrial discharge, may be identified by examining release information. In this case, the exposed population is the swimmers in those specified receiving waters. The final step in Volume 4 is to characterize the exposed population according to age, and/or sex. This is accomplished by consulting Census Bureau publications.

6. CALCULATING EXPOSURES

This section provides the analytical framework for ambient exposure analysis along with an explanation of each of the operations involved in calculating exposure. This method addresses three types of exposure: inhalation exposure to humans, dermal exposure to humans (via outdoor swimming), and exposure to aquatic biota. The emphasis will be on assessments of a general nature. Less common types of exposure may become relevant in more detailed assessments (e.g., ingestion of contaminated soil by children); these must be dealt with on a case-by-case basis. Since they are not expected to be significant in general assessments, they will not be discussed further.

The framework for calculating exposure for each exposure route has been outlined in subsection 1.3. Subsection 6.1 addresses identification of exposed populations. The succeeding subsections discuss the individual analytical components of the framework for each of the three types of exposure.

The primary reason for calculating exposure is ultimately to determine the risk to the general population posed by the chemical substance being studied. For aquatic biota, exposure and effects data are usually expressed in terms of concentration. For human populations, exposure is usually calculated in terms of dosages. The goal of calculating exposures is to provide exposure information in a format compatible with effects data.

6.1 Identification of Exposed Populations

The frameworks for calculating exposure provided in Section 1.3 generate a measure of exposure to particular individuals. In order to completely evaluate the significance of exposure, one must be able to determine not only who is exposed but how many individuals are exposed at various levels and what demographic characteristics affect exposure. Thus, there are three components in the analysis of receptor populations:

1. Identification
2. Enumeration
3. Characterization

Only the first of these is covered in this volume; enumeration and characterization are addressed in Volume 4 of this report.

6.1.1 Ambient Air

Unlike some other types of exposures which are related to performing particular activities, ambient inhalation exposures affect the entire population of an area. For this reason, the exposed population is identified primarily by geography, i.e., the areas where specific concentration ranges occur. For example, the population exposed to atmospheric concentrations of a chemical released by an industrial site would be those persons inhabiting the region around the source; the identified region must be large enough to account for prevailing meteorological conditions and to allow for ultimate dispersal/dilution to negligible levels. This population would be divided into subgroups according to the concentration ranges.

Population mobility (annual, seasonal, daily) obviously affects which atmospheric concentrations people are exposed to. For general exposure assessments, however, it is possible to disregard mobility and assume that the population exposed via inhalation is composed of the people who reside in the specific area.

The population movements most likely to be of importance in a more detailed exposure assessment are principally the result of diurnal shifts of the population between place of employment and place of residence. While no method is presented to account for population mobility patterns, it is possible to present generic mobility data for geographic census categories; this is presented in Volume 4 of this series.

The exposure assessment team may use these data when it is determined that identification and enumeration of exposed subpopulations are required. For point sources, the boundaries of SMSAs and central cities would have to be determined in relation to the ATM sector areas. Net population movements could then be determined for the area of interest. The data, however, would be most useful to identify and enumerate populations exposed via area source emissions, particularly if the estimated concentrations as a result of area source emissions are modeled according to the described census geographic categories.

6.1.2 Ambient Water

For purposes of these methods, it is assumed that human exposure via ambient water is potentially significant only through dermal absorption resulting from swimming in rivers, lakes, or oceans. Other activities, such as fishing, boating, and water skiing, could also lead to exposure, but these are of lesser importance because of the low availability of skin surface, or because of relatively low periodicity (Scow et al. 1979). They may be of importance in more detailed assessments, however. Consult Scow et al. (1979) to determine if a given type of exposure may be significant.

6.1.3 Aquatic Biota

Exposures to aquatic biota are sometimes analyzed in terms of effects on specific target populations, but more often, the most sensitive species are unknown and no specific population is identified. When some information is required on a particular aquatic population, it is usually with regard to fish, since most available aquatic toxicity data are on fish. Data sources for determining whether specific fish populations are present in a stream reach or river basin include field guides by Lee et al. (1980) and McClane (1978).

6.2 Inhalation Exposures

Exposure via inhalation is usually the most significant type of human exposure in the ambient environment because inhalation is continuous. Exposure to airborne toxics through inhalation is limited only by (1) the period of time the receptor population is subjected to the contaminated atmosphere (periodicity) and (2) the rate at which the average receptor brings the contaminated air to the body boundary (i.e., the lungs and nasopharynx) for absorption (ventilation rate). Hence, the calculation of inhalation exposure is based on periodicity (hours/year), ventilation rate (m^3 hour), and ambient concentration (ug/m^3). The arithmetic relationship of these parameters was illustrated earlier in this volume in Section 1.3.

Inhalation exposures are usually keyed to geographic location, i.e., ambient concentration is assumed to be homogeneous throughout a limited area or sector, and all of the population in that area is considered to be exposed to the same concentration. This assumption is not always well-founded, however. Numerous studies have shown that there can be marked differences in indoor and outdoor concentrations of pollutants (Budiansky 1980; Moschandreas et al. 1980) or within other types of environments in the same area (Ott 1981). To account for these differences when calculating exposure, several investigators have coined the term "microenvironment," which refers to a type of physical setting where concentrations of pollutants can be expected to be similar. For example, in his studies of carbon monoxide, Ott (1981) postulates several microenvironments, including such areas as inside parking garages, inside one's home, and inside an office building.

For ambient inhalation exposures to toxic substances, three microenvironments can be used to describe differences in concentrations: outdoors, indoors, and in-vehicle. Other microenvironments may need to be postulated for specific pollutants with multiple source types or other factors which would result in significant nongeographic differences in concentrations. It is appropriate to evaluate exposure separately for these microenvironments only under certain conditions; for most general and long-term assessments, it is common to assume that concentrations are homogeneous throughout a given area. The conditions that most obviously merit specific microenvironment consideration are those in which the toxic substance under study is:

1. Generated indoors - In this case concentrations indoors will be greater than those outdoors or in-vehicle. Most of these situations are covered by the consumer scenario (Volume 7 of this report).
2. An extremely reactive gas - These may have lower indoor concentrations because the greater surface-to-volume ratio indoors offers more substrate for reaction.
3. Particulate - Concentrations indoors and in-vehicles may be reduced by infiltration through structures (assuming outdoor sources).
4. Released episodically - Concentrations indoors lag behind outdoor concentrations, thus buffering the extremes.

Other conditions may be evaluated on a case-by-case basis for more detailed or short-term assessments. Each of these conditions is explained more fully below. It is worth emphasizing that if none of these conditions is met, a conventional atmospheric model can be used and no adjustments need to be made in periodicity and ventilation rate. If any of the conditions are met, use the techniques explained under each of the appropriate subsections (on periodicity, ventilation rate, and ambient concentration) to calculate exposure separately for each of the microenvironments.

Condition 1 - Indoor Sources

When indoor sources (e.g., fuel combustion) release pollutants, the advective processes that usually reduce ambient concentrations between the source and receptor do not have the opportunity to occur. In this case, model the indoor concentrations and use the periodicity value for the indoor microenvironment only. An example of a situation where this would be appropriate is provided by Moschandreas et al. (1981), who observed significantly higher levels of benzo(a)pyrene indoors than outdoors during use of residential fireplaces and wood stoves.

Condition 2 - Reactive gases

Sulfur dioxide (SO_2) and ozone (O_3) are the reactive gases that have been monitored most extensively in simultaneous indoor/outdoor studies. Table 9 summarizes the relationships found for indoor and outdoor concentrations. All of the studies found that indoor concentrations were lower than outdoor concentrations. The mechanism hypothesized to reduce indoor concentrations is reaction with surfaces;

Table 9. Indoor/Outdoor Relationships for Reactive Gases
(No indoor source is postulated for these pollutants.)

Reference	Pollutant	Comments[1]
Anderson 1971	SO_2	I/O = 0.51
Chamberlain 1966	SO_2	I/O = 0.60
Moschandreas et al. 1978	SO_2	I/O <1
Moschandreas et al. 1981	SO_2	I/O <1
McCaroll 1978	SO_2	I/O <1
Phair et al. 1958	SO_2	I/O <<1
Spengler et al. 1978	SO_2	0.35 <I/O <0.70
Walsh et al. 1977	SO_2	Reduction in indoor levels due to rapid sorption by furnishings, especially cellulose wallpapers, fabrics, and carpets.
Weatherly 1966	SO_2	I/O = 0.60. No effect caused by opening or closing windows.
Sabersky et al. 1973	O_3	I/O <1. Lag in concentration between indoor and outdoor. Decomposition rate constants for several surfaces ranged from 10^{-1} to 10^{-3} ft^3/ft^2 - min.
Moschandreas et al. 1978	O_3	I/O <1 for 95% of paired observations. Typically, 0.3 <I/O <0.5. Estimated indoor half-life = 2 min.
Moschandreas et al. 1981	O_3	I/O <1.

[1] I/O = Ratio of indoor to outdoor concentrations.

degradation occurs much more rapidly indoors because of the greater availability of surface area (high surface-to-volume ratio). Any toxic substance that is a strong oxidant, has a high affinity for surface reactions (e.g., organic acids), or is otherwise very reactive (half-life of ten hours or less) should be considered a candidate for modeling indoors; i.e., it should not be assumed that outdoor concentrations are representative.

The influence of decay half-life (e.g., sorption, transformation) on the ratio of indoor to outdoor concentrations is shown in Table 10 for several exchange rates. Typical exchange rates found in the literature range from about 0.25 to 3 air changes per hour (ach) for residences, with 1 ach frequently being used as an average value. The calculations shown in this table could conceivably be used to adjust outdoor concentrations to indoor concentrations. Unfortunately, there are currently no known estimating methods for predicting the rates of decay reactions indoors. Further work is needed in this area before exposure to reactive gases can be fine-tuned by microenvironment.

Condition 3 - Particulates

A number of studies have described the relationships between indoor and outdoor concentrations of particulates. In many cases, concentrations are roughly equal (Jacobs et al. 1962, Chamberlain 1966, Weatherly 1966, Moschandreas et al. 1978) or are even higher indoors than outdoors (Dockery and Spengler 1978, Hollowell et al. 1976, Hollowell and Trayner 1978, Moschandreas et al. 1981). When the concentrations of particulates from indoor sources (e.g., smoking, fuel combustion, cooking) are discounted, however, it is apparent that there is significant filtration of outdoor air (Alzona et al. 1979, Cohen and Cohen 1980, Dockery and Spengler 1978).

Additional studies have demonstrated that the particle size distribution of particulates indoors is different from that outdoors, with more of the total being toward the smaller size indoors (Jacobs et al. 1962, Manoharan et al. 1961). Therefore, indoor concentrations of pollutants associated with particulates from outdoor sources are less than those predicted based on atmospheric modeling alone, although a higher proportion of the particles may be respirable.

An example of this situation is exposure to lead. This element is associated with particulate emissions from transportation and is found at lower levels in apartments, residences, and office buildings than in the outdoor air immediately surrounding them (Halpern 1978, Moschandreas et al. 1978, Alzona et al. 1979, Cohen and Cohen 1980, Moschandreas et al. 1981). Similar relationships have been found for other trace elements as

Table 10. Indoor/Outdoor Ratios Corresponding to Various Reactive Half-Lives
(Tabulated values are indoor/outdoor concentration ratios.)

	Exchange rate, γ (air changes per hour)		
Reactive half-lives (hours)	0.25	1.0	3.0
1	0.26	0.59	0.81
2	0.42	0.74	0.90
3	0.52	0.81	0.93
4	0.59	0.85	0.95
5	0.64	0.88	0.96
10	0.78	0.94	0.98
20	0.88	0.97	0.99

Derivation: The Geomet Indoor/Outdoor Air Pollution Model (GIOAP) (Moschandreas et al. 1978) can be used to describe the relationships between indoor and outdoor sources. The following assumptions were employed:

1. There are no indoor sources of the toxic substance.
2. Outdoor concentration is constant.
3. Exchange rate and degradation rate are constant. Using these assumptions, the closed form solution to the GIOAP model under equilibrium conditions (i.e., adequate time to reach steady state) can be reduced to:

$$\frac{C_{in}}{C_{out}} = \frac{\gamma}{D + \gamma}$$

where: C_{in} = indoor concentration
C_{out} = outdoor concentration
γ = exchange rate, air exchange/time
and D = decay factor, time^{-1}.

The term D can also be expressed as:

$$D = \ln 2/t_{1/2}$$

where: $t_{1/2}$ is the half-life with respect to all decay processes (e.g., sorption, transformation).

Therefore:

$$\frac{C_{in}}{C_{out}} = \frac{\gamma}{(\ln 2/t_{1/2}) + \gamma}$$

This equation was used to calculate the indoor/outdoor ratios tabulated above.

well (Colome et al. 1978, Cohen and Cohen 1980, Moschandreas et al. 1981) and also apply to air within vehicles (Alzona et al. 1979).

Clearly, then, some adjustment of outdoor concentrations is appropriate when the toxic substance being studied is associated with particulates so as not to overestimate exposure in the indoor and in-vehicle microenvironments. Methods of adjustment are addressed later under ambient concentration (Section 6.2.3.(1)).

Condition 4 - Episodic Releases

Several studies have shown some lag period before indoor concentrations respond to differences in outdoor concentrations (Lefcoe and Inculet 1975, Derham et al. 1974, Halpern 1978, Phair et al. 1958, Sabersky et al. 1973). This lag is generally on the order of one to three hours, depending on the exchange rate (air changes per hour) of the structure. The lag tends to buffer rapid changes in outdoor air concentration and has an averaging effect. This lag could be important in short-term or extremely detailed exposure assessments where the effects of population mobility and daily activities are accounted for. The current state of the art in estimating periodicity of releases and modeling concentrations on an hourly (or even shorter) time step does not provide sufficient resolution to allow evaluation of the effects of this phenomenon. Personal monitoring is currently the only feasible method to account for such short-term variations.

All Other Cases

For general assessments, it is common to assume that concentrations in a local area are homogeneous, and thus microenvironments are not broken out. For more detailed and short-term assessments, the necessity of defining additional microenvironments must be evaluated individually.

6.2.1 Periodicity

For the general cases of inhalation exposure calculation, the concentration of the chemical in the atmosphere is assumed to be equal throughout the local ambient environment. Here, the periodicity of exposure is assumed to be continuous for one year so that the frequency factor F becomes unity and P=D (Figure 2).

Periodicity = 8,760 hours/year = 24 hours/day x 365 days/year

A more detailed approach to determining periodicity may be desired when exposure is known to be limited to one microenvironment (e.g., indoors), or if ambient atmospheric concentration of the contaminant may differ significantly from one microenvironment to another (e.g., particulate filtration from the outdoor to indoor microenvironments). The average time spent in each microenvironment is provided in Tables 11 and 12. Though there is some discrepancy in the format of the two tables, the estimates on time spent in the three microenvironments agree fairly well. There is an indication that these figures are biased to adult respondents and that locations may be defined slightly differently in each report; "inside one's home" may not be equivalent to "indoors," and where one study has broken out work time, the other may not have. Nevertheless, it is possible to estimate a typical distribution of time for adults in the three microenvironments from a synthesis of these two tables:

	Indoors-	90%	(x 8,760 hrs/yr) = 7,884 hrs/yr
Periodicity	Outdoors-	5%	(x 8,760 hrs/yr) = 438 hrs/yr
	In-vehicle-	5%	(x 8,760 hrs/yr) = 438 hrs/yr

6.2.2 Ventilation Rate

In general application, a common value for ventilation rate can be used to calculate exposure via inhalation. An example of an adult average derived from experimental results (USEPA 1981b) is a ventilation rate of 1 m^3/hour. This value can be used to estimate exposure regardless of microenvironments or activity.

A more precise estimate of ventilation rate for each microenvironment can be derived by generating time-weighted average ventilation rates. The basis for this calculation is microenvironment-related data and activity stress levels/ventilation rates associated with the individual microenvironments.

The SRI data base (Roddin et al. 1979) is a computerized data base that offers statistical analysis and retrieval of human time-diary data collected from various sources. This section discusses the data derived from the SRI data base in terms of amount of time spent indoors, outdoors, and in-transportation vehicle at the three stress levels (high, medium, and low). These data may be used to estimate ventilation rates for each stress level in each microenvironment.

The SRI data are presented for five microenvironments: (1) indoors work-school, (2) other indoors, (3) in-transportation vehicle, (4) other transportation, and (5) outdoors. These five microenvironments were aggregated into three microenvironments to facilitate use of the data: "other indoors" was aggregated with "indoors work-school" to produce the indoor microenvironment, and "other transportation" with "in-transportation vehicle" to produce the in-vehicle microenvironment. The outdoor microenvironment remained the same. The data presented in

Table 11. Estimated Time Spent in Three Microenvironmental Categories

Location	Hours/day		Percent of day	
	Employed men	Housewives	Employed men	Housewives
Indoors	21.7	22.9	90	95
Outdoors	0.7	0.3	3	1
In-vehicle	1.6	0.8	7	3

Source: NAS 1981.

Table 12. Percentage of Time Spent in Each Microenvironmental Category

Location	Percentage of day*		
	All persons	In labor force	Not in labor force
Inside ones home	73	57	89
In-transit	6	6	4
At work	14	31	0
Other locations	7	6	7

*"All persons" reported to include all races, ages, socioeconomic statuses, (workers, housewives, students, etc.).

Source: Moschandreas et al. 1981.

Table 13 are the percent of time spent in each of the five SRI microenvironments and within each stress level. These figures were derived by taking the mean of the four "Activity Files" maintained within SRI, which represent four discrete data sets. Table 14 shows the aggregated figures for the indoor, outdoor, and in-vehicle environments at each stress level, and Table 15 shows total time spent at each stress level. All data presented represent averages for both sexes and all age groups.

Table 16 illustrates ventilation rates as minute volume ($\mathring{V}$ in ℓ/min) for four stress levels (resting, light, heavy, and maximal). Average ventilation rates for each of the four stress levels were calculated by taking the mean of all data points at each stress level. This yields:

Activity Stress Level	Average Ventilation Rate
Maximal	68 ℓ/minute
Heavy	34 ℓ/minute
Light	20 ℓ/minute
Resting	4 ℓ/minute

Since the SRI data present only three stress levels, these four rates were averaged to correspond to three levels. Rates for maximal and heavy activity, heavy and light, and light and resting were averaged; the three resultant values represent "high," "medium," and "low."

Activity Stress Level	Average Ventilation Rate
High	51 ℓ/minute (3.06 m^3/hr)
Medium	27 ℓ/minute (1.62 m^3/hr)
Low	12 ℓ/minute (0.72 m^3hr)

A time-weighted average ventilation rate for each microenvironment can be calculated by tabulating the microenvironment/ventilation information as is done in Tables 17 through 19, where percent of time spent in a microenvironment (a) is multiplied by the average ventilation rate (c), and summed for all three stress levels. Thus,

$$V = \sum a_n \cdot c_n = X\ m^3/hr$$

A total daily ventilation rate based on the data in Table 15 and the inhalation rates for each stress level can be calculated as a time-weighted average for all ages, sexes, activities and microenvironments equal to an estimated rate of 0.79 m^3/hour.

Table 13. SRI Data on Time Spent In Each Microenvironment at Each Stress Level

Microenvironment & stress level	Mean percent activity 1	Mean percent activity 2	Mean percent activity 3	Mean percent activity 4	Mean percents for all activity files
IWL (indoors work-school low)	6.90	6.73	7.13	6.99	6.94
IWM (indoors work-school med)	.19	.61	.94	.33	.52
IWH (indoors work-school high)	.10	.11	.11	.08	.10
OIL (other indoors low)	73.89	76.01	75.91	73.84	74.91
OIM (other indoors med)	2.45	2.27	2.44	2.56	2.43
OIH (other indoors high)	.47	.19	.19	.37	.31
TVL (trans. vehicle low)	7.57	6.65	6.25	7.39	6.97
TVM (trans. vehicle med)	0	0	0	0	0
TVH (trans. vehicle high)	0	0	0	0	0
OTL (other trans. low)	.19	.23	.17	.17	.19
OTM (other trans. med)	.24	.17	.16	.20	.19
OTH (other trans. high)	.0069	.0019	.0047	.0064	.0050
ODL (outdoors low)	4.63	3.82	3.78	4.61	4.21
ODM (outdoors med)	2.76	2.63	2.52	2.85	2.69
ODH (outdoors high)	.49	.51	.40	.53	.48

Table 14. SRI Data Aggregated for Three Microenvironments by Stress Level

Ambient microenvironments and associated stress levels		Average percent of time spent in each	Hours or fraction of hour spent in each microenvironment
INDOORS	L	81.85	19.64
	M	2.95	.71
	H	.41	.098
	TOTAL	85.21	
OUTDOORS	L	4.21	1.01
	M	2.69	.65
	H	.48	.12
	TOTAL	7.38	
IN TRANSPORTATION VEHICLE	L	7.16	1.72
	M	.19	.05
	H	.0050	.0012
	TOTAL	7.36	
TOTAL		~100	~24 hours

Table 15. Total Percent of Time Spent At Each Stress Level

Stress level	Total percent of time
Low	93.2
Medium	5.8
High	.9

Table 16. Selected Lung Ventilation Values at Different Levels of Activity as a Function of Age and Sex

Col.	1	2	3			4			5			6		
			Resting			Light activity			Heavy work			Maximal work during exercise		
Line	Subject	W (kg)	f	VT	$\overset{\circ}{V}$	f	VT	$\overset{\circ}{V}$	f	VT	$\overset{\circ}{V}$	f	VT	$\overset{\circ}{V}$
	Adult													
1	Man	68.5	12	750	7.4	17	1670	29	21	2030	43			
2	1.7 m^2SA		12	500	6									
3	30 y: 170 cm L		15	500	7.5	16	1250	20						
4	20-33 y	70.4										40	3050	111
5	Woman	54	12	340	4.5	19	860	16	30	880	25			
6	30 y; 160 cm L		15	400	6	20	940	19						
7	20-25 y; 165.8 cm L	60.3										46	2100	90
8	Pregnant (8th mo.)		16	650	10									
	Adolescent													
9	♂, 14-16 y		16	330	5.2									
10	♂, 14-15 y	59.4										53	2520	113
11	♀, 14-15 y		15	300	4.5									
12	♀, 14-15 y; 164.19 cm L	56										52	1870	88
	Children													
13	10 y; 140 cm L		16	300	4.8	24	600	14						
14	♂, 10-11 y,	36.5										58	1330	71
15	♀, 10-11 y; 140.6 cm L	32.5										61	1050	61
16	♂, 4-6 y	20.8										70	600	40
17	♀, 4-6 y; 111.6 cm L	18.4										66	520	34
18	Infant, 1 y		30	48	1.4[a]									
19	Newborn	2.5	34	15	0.5									
20	20h-13 wk	2.5-5.3										68[b]	51[a,b]	3.5[b]
21	9.6 h	3.6	25	21	0.5									
22	6.6 d	3.7	29	21	0.6									

Values in column 2 are body weights referable to the dimension quoted in column 1. f = frequency (breaths/min); VT = tidal volume (ml); $\overset{\circ}{V}$ = minute volume (l/min); SA = surface area.

[a] Calculated from $\overset{\circ}{V} = f \times VT$.

[b] Crying.

Source: From ICRP 1974.

Table 17. Calculation of Average Ventilation Rate for Indoor Microenvironment

(a) Percent of total time spent in indoor microenvironment for average respondent	(b) Activity stress levels	(c) Average ventilation rate for average respondent
0.48	High	3.06 m^3/hr
3.46	Medium	1.62 m^3/hr
96.06	Low	0.72 m^3/hr

$$\begin{aligned} V = \sum an \times Cn &= [(0.0048)\ (3.06\ m^3/hr)] \\ &+ [(0.0346)\ (1.62\ m^3/hr)] \\ &+ [(0.9606)\ (0.72\ m^3hr)] \\ &= 0.76\ m^3/hr \end{aligned}$$

Table 18. Calculation of Average Ventilation Rate for Outdoor Microenvironment

(a) Percent of total time spent in outdoor microenvironment for average respondent	(b) Activity stress levels	(c) Average ventilation rate for average respondent
6.5	High	3.06 m^3/hr
36.40	Medium	1.62 m^3/hr
57.05	Low	0.72 m^3/hr

$$\begin{aligned} V = \sum an \times Cn &= [(0.065)\ (3.06\ m^3/hr)] \\ &+ [(0.0364)\ (1.62\ m^3/hr)] \\ &+ [(0.5705)\ (.72\ m^3hr)] \\ &= 1.20\ m^3/hr \end{aligned}$$

Table 19. Calculation of Average Ventilation Rate for In-Transportation Vehicle Microenvironment

(a) Percent of total time spent in in-transportation vehicle environment for average respondent	(b) Activity stress levels	(c) Average ventilation rate for average respondent
0 .68	High	3.06 m^3/hr
2.58	Medium	1.62 m^3/hr
97.28	Low	0.72 m^3/hr

$$\begin{aligned} V = \sum an \times Cn &= [(0.0068)\ (3.06\ m^3/hr)] \\ &+ [(0.0258)\ (1.62\ m^3/hr)] \\ &+ [(0.9728)\ (0.72\ m^3 hr)] \\ &= 0.76\ m^3/hr \end{aligned}$$

6.2.3 Ambient Air Concentrations

The final analytical component needed to calculate inhalation exposure is ambient concentration. Ambient concentration can be determined in either of two ways: (1) from monitoring data or (2) by atmospheric modeling. Sources of monitoring data are discussed in Section 4.2.1. Monitoring data for toxics in ambient air are very rare, however, so most exposure assessments on existing chemicals and all exposure assessments on new (PMN) chemicals must rely on modeling. The analytical procedure for modeling involves the following steps:

1. Selecting the model
2. Identifying geographic locations
3. Determining source strength
4. Characterizing emissions
5. Retrieving environmental transport data
6. Analyzing fate processes
7. Executing the model

Each of these is discussed below.

(1) Model Selection. As with all of the other components of this method, the level of detail (and uncertainty) involved in modeling ambient concentrations can be varied commensurate with the objectives of the investigation and the accuracy of input data. A detailed exposure assessment might require modeling each source under various environmental (e.g., meteorologic) conditions. A general assessment might use one "typical" source and "canonical" environmental conditions (i.e., conditions considered to be representative of various environmental types) to estimate the long-term distribution of concentrations around a source. These concentrations might then be extrapolated to all geographic locations around sources.

The Modeling Team of OTS's Exposure Evaluation Division (EED) is developing a system of models for all ambient media. Development has emphasized providing the level of detail required to perform exposure assessments for both new chemicals (PMNs) and existing chemicals to support screening or detailed reviews. The models described below are those adopted by the EED Modeling Team, except that some additional information is provided on modeling indoor and in-vehicle concentrations. It should be noted that this list is not intended to designate the only appropriate models; these are simply the ones that have been most useful or most readily accessible. For indoor sources, the GIOAP model is discussed as the leading candidate for estimating indoor concentrations. Outdoor sources are generally considered to be line, area, or point sources; representative models for each type are briefly described. Finally, it was possible to develop some rough scaling factors for estimating indoor concentrations of particulates based on outdoor concentrations; these are discussed at the end of this subsection. Other models are described in the EPA "Draft Directory of Models and Data Bases" (USEPA 1981c), the "Workbook for Comparison of Air Quality Models" (Smith et al. 1978), the "EPA Environmental Modeling Catalogue" (USEPA 1982), and more recently in the Environmental Mathematical Pollutant Fate Modeling Handbook/Catalogue (Draft) prepared by the Office of Policy and Resource Management, U.S. EPA (Bonazountas et al. 1982). Table 20 lists the models that have been reviewed by the handbook/catalogue, highlighting their particular capabilities. Due to the excess of information on each of the models, additional information on use, access, and characteristics has not been included here, but can be found in the referenced document.

Indoor Source - GIOAP

The GEOMET Indoor/Outdoor Air Pollution (GIOAP) Model (Moschandreas et al. 1978) is a leading model that has been verified by observations of several chemicals. This model is recommended for estimating indoor concentrations of toxic chemicals emitted by an indoor source. Like other indoor air models, it is founded on a mass balance equation, expressed as (Moschandreas et al. 1978):

$$V \frac{dC_{in}}{dt} = V\gamma C_{out} + S - V\gamma C_{in} - VDC_{in} \text{ for } t_o \leq\, < t_f$$

where

C_{in} = indoor pollutant concentration, mass/volume

C_{out} = outdoor pollutant concentration, mass/volume

V = volume of the structure, volume

S = rate of indoor pollutant emission, mass/time

D = decay factor, time^{-1}

γ = air infiltration rate of the structure, air changes/time

t_o = initial time

t_f = final time

The first two terms on the right-hand side of the equation represent the rate of increase in indoor pollutant mass due to contribution of outdoor air ($V\gamma C_{out}$) and indoor sources (S). The last two terms represent pollutant removal due to exfiltration of indoor air ($V\gamma C_{in}$) and decay processes (VDC_{in}). Thus, the sum of these factors is the rate of change of the indoor pollutant mass $\left(V \frac{dC_{in}}{dt}\right)$.

TABLE 20
CAPABILITIES OF REVIEWED MODELS

MODEL FUNCTION	APRAC-1	CDM	CRSTER	HIWAY-2	ISC	MPTER	PAL	PTMAX PTDIS PTMTP PTPLU	RAM	TCM	TEM	VALLEY	ATM (UTM-TOX)
POINT SOURCE		●	●		●	●	●	●	●	●	●	●	●
AREA SOURCE	●	●			●		●		●	●	●	●	●
LINE SOURCE	●			●			●						●
VOLUME SOURCE					●								
SHORT-TERM	●		●	●	●	●	●	●	●		●	●	●
LONG-TERM		●	●		●				●	●		●	●
PLUME TRAPPING	●	●	●	●	●	●	●	●	●		●	●	●
HALF-LIFE		●			●	●			●	●	●	●	●
GRAVITATIONAL SETTLING					●	●	●						●
AERODYNAMIC EFFECTS		●		●	●		●						
BUOYANT PLUME RISE		●	●		●	●	●	●	●	●	●	●	●
MOMENTUM PLUME RISE					●	●			●	●	●		
STACK DOWNWASH					●	●		●	●		●		
TURBULENT DEPOSITION						●	●						●
TERRAIN ADJUSTMENT			●		●	●						●	
COMPLEX TERRAIN						●						●	
CALIBRATION		●								●			
URBAN/RURAL DISPERSION * COEFFICIENT	U	U	●	R	●	●	R	R	●	●	●	●	●
BACKGROUND CALCULATED	●												
STREET CANYON FLOWS	●												
WIND SPEED EXTRAPOLATION		●	●		●	●	●	●	●	●	●		●
HIGHWAY GENERATED TURBULENCE				●	●		●						
EMISSION RATES FUNCTION OF MET CONDITIONS					●								
EMISSION RATE FUNCTION OF TIME OF DAY	●				●	●			●				
BUOYANCY INDUCED DISPERSION						●		●					
σ_y FUNCTION OF AVERAGING TIME AND STABILITY											●		
INVERSION PENETRATION FACTORS											●		
PARTICLE RESUSPENSION													●
WASHOUT													●
NO. OF SOURCES (MAX.)	1200	200 P 2500 A	19	24	100	250	180	25 (PTMTP)	250 P 100 A	UN-LIMITED	300 P 50 A	50	30
NO. OF RECEPTORS (MAX.)	625	UN-LIMITED	180	50	400	180	30	30 (PTMTP)	150	2500	2500	112	40

* U = URBAN ONLY, R = RURAL ONLY

SOURCE: BONAZOUNTAS et al. 1982.

The decay term is assumed to be first order and is the sum of all processes transforming the chemical (e.g., oxidation, adsorption). It can be expressed as:

$$D = \ln 2/t_{1/2}$$

where $t_{1/2}$ = the half-life of the chemical.

As previously mentioned, methods have not yet been developed for predicting D, and predictions based on hydroxyl radical attack or ozone oxidation (used for outdoor dispersion modeling) are probably inappropriate. More work is needed in this area.

Outdoor air concentration can be generated using one of the models; which will be discussed subsequently, unless it can reasonably be assumed to equal zero. Over short time intervals, C_{out} can be approximated by a line with the form:

$$C_{out} = m \cdot t + b$$

where:

m = slope of the line, mass/volume · time
t = time
b = y-intercept of the line, mass/volume.

Then, if S, D, and γ are assumed constant over the time period of interest (and we denote C_{in} as C),

$$V \frac{dC}{dt} = V(mt + b) + S - V\gamma C - VDC.$$

If we denote the indoor concentration at time zero as C_0, the following closed-form solution obtains (Moschandreas et al. 1978):

$$C(t) = \left[C_0 - m\left(\frac{\gamma}{D+\gamma}\right)t_0 - \left(\frac{1}{D+\gamma}\right)\left(\gamma b + \frac{S}{V} - \frac{\overline{m}\gamma}{D+\gamma}\right)\right] + \left(\frac{1}{D+\gamma}\right)\left(\gamma b + \frac{S}{V} - \frac{m\gamma}{D+\gamma}\right) + m\left(\frac{\gamma}{D+}\right)t$$

for $t_0 \leq t \leq t_f$.

In many cases, the temporal resolution in the data will be poor, and the system will be assumed to be at a steady-state equilibrium. In this instance, $t >> t_0$; therefore, the exponent of e in the above equation approaches $-\infty$, and the first term is negligible. Also, since C_{out} is constant, m is zero and the third term drops out. Thus, the equation can be reduced to

$$C = \left(\frac{1}{D+\gamma}\right)\left(\gamma b + \frac{S}{V}\right)$$

The variable b is equal to C_{out} in this equation.

Moschandreas et al. (1978) performed a sensitivity analysis on the output of the model based on perturbation of input parameters. In descending order of sensitivity, the input parameters rank as follows: air infiltration rate, decay rate, indoor source strength, and initial concentration and volume of the structure. There is considerable variation in values of infiltration rate among structures; based upon a very brief review of the literature, a typical value for residential structures is 1 air change per hour (the range is about 0.3 to 4 ach). Decay rate, source strength, and initial concentration are all chemical-specific terms. If the steady-state equation is used, the last factor is not needed. Volumes of residences are on the order of 150 to 700 m^3. Volumes of different types of conventional residences sampled by Moschandreas et al. (1978) are as follows:

Structural type (no. of observations)	Mean Volume, m^3	Range of Volume, m^3
Detached (3)	565	514 - 611
Semidetached (1)	385	-
Mobile (2)	187	181 - 194
Low-rise apartment (3)	183	183 - 183
High-rise apartment (3)	205	205 - 205

These may not be representative of typical volumes because of the limited number of samples.

Line Source - UNAMAP Series

Line sources are generated by vehicles that travel along a route (or line) such as a road, railway, or river. At present, no specific line source models have been applied by OTS for modeling toxics. Some line source models are available from the EPA UNAMAP (User's Network for Applied Modeling of Air Pollution) series (e.g., HIWAY), but these would have to be modified because they were conceived and designed for use with the air quality program's criteria pollutants. Because (1) OTS rarely has use for line source models and (2) it is probable that existing line source models would have to be modified in a pollutant-specific manner, investigation of line source models for this methodology was limited to identifying the UNAMAP series as a starting point for model selection.

Area Sources - Atmospheric Box Model

Area sources are those sources that cannot be described as specific point sources because releases are too widespread or exact locations are not known. They are similar to line sources insofar as many individual generators contribute to release. Situations where an area source model might be used are for modeling ambient concentrations resulting from residential combustion (e.g., heating oil, natural gas), release from consumer goods, releases from commercial establishments, or other cases where there are a number of diffuse release points.

The Atmospheric Box Model is currently used by OTS for modeling area sources. Required inputs are meteorological conditions (wind speed, mixing height), release rates (mass/area/time), and size of release area (Hall et al. 1981). The model can also account for degradation, precipitation scavenging, and deposition if the appropriate rate factors are input. Output is average ground level concentration within the release area on an hourly, monthly, or annual basis.

Point Sources - ATM

Point sources are known locations identifiable by geographic coordinates for which emissions of a specific chemical can be estimated and assigned. If there is more than one point source, they must be separated enough to ensure uniqueness during analysis. Also included in this category are general point sources. These are sources of chemical emissions for which prototypes are defined and analyzed because the actual sources are too numerous to allow identification of specific locations with geographic coordinates. Prototype sources are defined for different regions, if necessary, and modeled in the same fashion as specific point sources. The results can then be scaled to represent all sources of the same nature.

The Atmospheric Transport Model (ATM) is used by OTS to model point sources. ATM can model gaseous and particulate pollutants at distances of up to 50 km from a point source (Hall et al. 1981). Input data required include source location, emission type (process, storage, or fugitive), emission characteristics (i.e., stack height, vent radius, exit velocity, exit temperature), release rate, physicochemical parameters (degradation rate(s), particle size spectrum), and meteorological parameters (monthly wind rose data, atmospheric stability). Meteorological data have been catalogued for over 300 National Weather Service Stations (STAR stations); this data file is interfaced with the OTS version of ATM to allow selection of meteorological conditions for sites throughout most of the U.S. Average monthly or annual ground level pollutant concentrations are output for the 16 compass points at ten or more radii from the source. This model is also interfaced with a Census Bureau data file on populations to allow direct computation of number of people exposed to various concentrations (Hall et al. 1981).

Particulates - Scaling Factors for Indoor and In-vehicle Microenvironments

The approach recommended for estimating indoor or in-vehicle concentrations resulting from outdoor releases of particulate matter is to apply scaling factors to the outputs from the point, area, or line source models discussed previously. As mentioned earlier, numerous studies have documented simultaneous indoor and outdoor concentrations of particulates, but only a few have distinguished between the contributions of outdoor and indoor sources. Most notable among these are studies by Alzona et al. (1979) and Cohen and Cohen (1980).

In the former study, the air in various rooms was cleaned, and airborne particulate matter was collected (by filtration) simultaneously in the room and outdoors nearby. The filters were then analyzed for trace elements of outdoor origin. These elements, and the particle sizes with which they are typically associated, are calcium (0.65-20um), iron (3.6-20um), zinc (0.65-20um), lead (0.1-0.65um), and bromine (0.1-0.65um) (Alzona et al. 1979). Indoor concentrations reached an equilibrium ratio with outdoor concentrations within one day, and these ratios varied for different structural conditions. Mean indoor:outdoor ratios ranged from 0.10 (calcium) to 0.42 (lead) for various closed rooms. When tests were run with the windows wide open or cracked open, the ratios were considerably higher (see Table 21). By placing plastic over the internal surfaces of the room, it was determined that infiltration around the windows (when closed) was the primary mode of entry of the particulates; resuspension of particulates was not an important effect. Concentrations in vehicles with windows closed were signficantly less than outdoor concentrations.

Cohen and Cohen (1980) built upon the work of Alzona et al. (1979) by performing more analyses of calcium, iron, lead, and bromine in additional building types. They stated that calcium and iron are generally associated with large particles (about 5um) and lead and

Table 21. Indoor/Outdoor (I/O) Concentration Ratios for Elements Associated with Particulates. Effect of Various Conditions on I/O. All Measurements Taken in the Same Room.

No. of runs	Conditions	I/O Ca	Fe	Zn	Pb	Br
3	Normal	0.10	0.17	0.52	0.49	0.33
2	Plastic over windows	0.10	0.15	0.71	0.17	0.17
1	Window wide open	0.52	0.81	0.93	1.2	1.0
2	Window cracked open	0.20	0.16	0.69	0.55	0.53
6	All surfaces plastic covered	0.02	0.12	0.24	0.15	0.20
3	All but windows plastic covered	0.10	0.15	0.58	0.57	0.32

Source: Alzona et al. 1979.

bromine are associated with submicron particles. Results from the Cohen and Cohen (1980) and Alzona et al. (1979) studies are summarized in Table 22 for buildings and in Table 23 for vehicles. Based on these results, Cohen and Cohen (1980) conclude that, for chemicals associated with large particles, indoor concentrations are only about 20 percent of outdoor concentration when windows are closed. For submicron particles, indoor concentrations are on the order of 45 percent of outdoor concentrations. The authors are forthright in stating the limits of their procedures, i.e., that although a variety of sampling sites were chosen, they cannot claim that the sites are representative of building occupancy throughout the nation. Nevertheless, these data and several other studies clearly show that exposure assessments which assume that outdoor concentrations of chemicals associated with particulates are equal to indoor concentrations (and in-vehicle concentrations) tend to overestimate exposure.

Therefore, pending development of better methods, outdoor concentrations (generated by the Atmospheric Box Model, ATM, or other models) should be adjusted by the scaling factors given in Table 24 to provide more realistic estimates of indoor concentrations of toxic chemicals associated with particulates. As the table shows, the ratios differ depending on whether windows are open or closed. The proportion of time with windows open depends on local climate, the prevalence of heating and air conditioning, and proximity of the buildings to sources (i.e., windows will be closed permanently if the source or other sources cause perennial air quality problems). The average scaling factors in Table 24 were calculated based on the assumption that windows are open 50 percent of the time and closed 50 percent of the time.

(2) Geographic Locations. Specific geographic locations of the sources are needed for two reasons: (1) so that the receptor populations can be identified and (2) to allow collection of site-specific environmental data (e.g., meteorology) required for modeling. The most useful format for geographic location is to list the latitude and longitude of the site.

Source information is generated by three processes:

1. Analysis of monitoring data.
2. Materials balance approach.
3. Applying emission factors to production volumes at production sites.

In the first case, the exact location of the sampling station is usually given because it is a standard descriptor of the monitoring regime. The second process, materials balance, is not described in this volume, but

Table 22. Summary of Indoor/Outdoor (I/O) Concentration Ratios for Buildings (windows closed)

Building type	Age*	Condition†	Windows	I/O+			
				Ca	Fe	Pb	Br
University, office	8	A	2	0.043(0.015)	0.077(0.021)	0.17(0.06)	0.41(0.18)
Public high school	60(1)	A	1	0.26(0.23)	0.095(0.036)	0.070(0.01)	0.18(0.06)
Public high school	60(1)	A	0	0.17(0.09)	0.13(0.06)	0.15(0.09)	0.25( )
University, office	25	C	4	0.15(0.08)	0.050(0.021)	0.19(0.07)	0.43(0.20)
Store	80(3)	B	20	0.064(0.016)	0.19(0.06)	0.31(0.10)	
Public elem. sch.	50	C	5	0.23(0.16)	0.44(0.18)	0.62(0.16)	0.57(0.28)
Commercial office	80(2)	C	4	0.14(0.09)	0.16(0.05)	0.27(0.05)	
Home, basement	50	B	5	0.38(0.30)	0.30(0.13)	0.44(0.10)	0.44(0.16)
Same, 3 wks later	50	B	5		0.32(0.10)	0.47(0.07)	
Home, attic	50	B	2	0.16(0.10)	0.31(0.17)	0.50(0.37)	
Home, attic	70	B	1	0.42(0.29)	0.15(0.03)	0.42(0.21)	
Home, kitchen	90	D	2	0.15(0.03)	0.26(0.04)	0.85(0.28)	
University, office	10	B	0		<0.10	<0.10	<0.10
University, lab	60	D	2		0.33	0.25	0.43
Home, bedroom	50	B	8		0.27	0.70	0.58
Home, attic	50	B	2		0.10	0.40	0.29
Home, bedroom	70	D	2	0.05	0.33	0.47	0.22
University, lab	60	D	3	0.08	0.13	0.31	0.25
University, office	25	C	3	0.15	0.54	0.47	0.58
University, lab	60	C	3	0.10	0.17	0.49	0.33
Average				0.17(0.08)	0.22(0.11)	0.38(0.16)	0.36(0.17)
Home average				0.23(0.13)	0.25(0.07)	0.53(0.12)	0.38(0.13)

*Parentheses indicate years since last remodeling.

†Condition: A-excellent; B-good; C-fair; D-poor.

+Parentheses indicate average deviation.

Sources: Cohen and Cohen 1980 and Alzona et al. 1979.

Table 23. Indoor/Outdoor (I/O) Concentration Ratios for Vehicles (Windows Closed)

	Indoor/Outdoor		
Type of vehicle	Fe	Pb	Br
Chevrolet Vega	0.27	0.41	0.36
Datson 440	0.09	0.12	0.24

Source: Alzona et al. 1979.

Table 24. Scaling Factors Recommended for Adjusting Outdoor Concentrations to Indoor and In-vehicle Concentrations

Predominant particle size	Indoor microenvironment[1] WC	WO	Avg.[2]	In-vehicle microenvironment[1] WC	WO	Avg.[2]
Less than 1 μm	0.4	1.0	0.7	0.4	1.0	0.7
Greater than 1 μm	0.2	0.6	0.4	0.2	1.0	0.6

Application: multiply outdoor concentration of particulate-associated chemical by factors to estimate indoor or in-vehicle concentration.

[1] WC = window closed and WO = window open.

[2] Average value based on assumption that windows are closed 50% of the time.

Based on data from Alzona et al. (1979) and Cohen and Cohen (1980), reproduced in Tables 21, 22, and 23.

the geographic coordinates of releases should be provided as an output of the process. The third process, using emission factors, is applied only to production sites.

Production sites can be identified by use of the same information sources that provide data on production volumes. These are listed in Table 1. The spatial resolution offered by these sources may be inadequate; for instance, when the address is a large city or county, a more exact location will be needed. Where more detail is required, options are:

1. Obtain a NEDS (National Emissions Data System) retrieval for the site. This will provide Universal Transverse Mercator coordinates of any major point sources (note that these may not coincide with the exact locations of process or fugitive releases, but they will at least be close). These coordinates can then be translated to latitude and longitude. NEDS is described in Sections 6.2.3(4) and 4.1.1, and Appendix A of this volume, and sample retrievals are given in Appendix C.

2. Obtain an IFD (Industrial Facilities Discharges) retrieval for the site. This is an aqueous effluent data base, and it provides only latitude and longitude of aqueous discharges; this is probably accurate enough for most applications. IFD is described in more detail in Sections 6.3.3(2) and 4.1.2, and Appendix A of this volume.

3. Call the EPA Regional Office and talk to staff members who deal with air, water, or hazardous waste enforcement. These people usually know, or have ready access to, information on exact site locations.

4. Call the company.

(3) Source Strength. Source strength is a measure of release rate to the atmosphere and is expressed in units of mass/time (e.g., g/sec or kkg/yr). The three procedures by which source strength can be determined, in descending order of preference, are:

1. Collect monitoring data.
2. Perform environmental materials balances.
3. Use estimating factors.

Each of these is explained below.

Monitoring Data

Monitoring data can provide the most reliable information on air emissions. Unfortunately, monitoring data on toxic substances in air are very rare or unavailable. The data bases that do provide data on air emissions are described in Section 4.1.1.

Environmental Materials Balances

Environmental materials balances are quantitative determinations of the flow rates of chemicals from the anthropogenic environment to the natural environment in terms of quantity, location, time, and chemistry. Environmental materials balances are concerned with the releases to different media, usually expressed on an annual basis. The methods for performing materials balances is beyond the scope of this report. If materials balances are required, use the release rate to the atmosphere as the source strength for modeling ambient concentrations.

Estimating Factors

The last method to use when determining air releases from production is to apply estimating factors to production volume. This method will indicate the approximate amount of product released to a specific medium as a percentage of production volume. It should be noted that estimating factors are crude approximations of releases and should be used only as a last resort when all other techniques have been exhausted.

Estimating factors were developed to account for the product releases to air from the manufacture of organic chemicals. Two methods were used to calculate this estimating factor:

1. The air release factors were derived by using a weighted average based on approximate unit process emissions. The contribution of emissions from each unit process was taken from White (1981). The actual numerical emissions (in kg of product/kkg of production volume) for each unit process were found in Versar (1982). Information from both sources is presented in Table 25.

   The estimated emission contribution percentage was applied to the actual numerical emissions to determine the weighted average. The weighted average was calculated based on the amount of available data. This average is for process emissions only. Therefore, to determine the total amount of emissions, it was assumed that process emissions account for 55 percent of total emissions (IT Enviroscience 1980).

Table 25. Estimated Emissions from Unit Processes

Unit process	Estimated emissions contribution to total synthetic organic chemicals manufacturing industry (%)	Amount of product released from each unit process (kg of product/kkg of production volume)	Emission factor for each unit process (%)
1. Oxidation	48.3	1.1	0.11
2. Halogenation	14.5	6.5	0.65
3. Hydrogenation	10.8	NA	NA
4. Esterification	6.9	1.6	0.16
5. Alkylation	4.0	NA	NA
6. Sulfonation	3.4	NA	NA
7. Dehydrogenation	2.7	0.228	0.0228
8. Hydrolysis	2.4	0.15	0.015
9. Reforming	2.2	NA	NA
10. Carbonylation	1.2	NA	NA
11. Oxyacetylation	1.0	NA	NA
12. Nitration	0.8	NA	NA
13. Dehydration	0.7	NA	NA
14. Ammonolysis	0.6	NA	NA
15. Condensation	0.5	NA	NA
16. Dealkylation	0	NA	NA
TOTAL	100.0		

NA - Not available.

Sources: White 1981 and Versar 1982.

2. The air emission factor was determined by averaging the product air releases reported in over 20 organic chemical materials balances (Versar 1980). Materials balances for numerous types of organic chemicals were examined, including aromatics and chlorinated hydrocarbons (see Table 26).

The results of the above two methods were very similar. The emission factors for the first and second methods were 0.39 and 0.31 percent of the total production volume, respectively. Therefore, the estimating factor for air was assumed to be 0.35 percent of the total production volume. Again, it must be noted that this estimating factor should be used with extreme caution. Emissions from organic chemical manufacturing are actually process- and site-specific and cannot be adequately estimated using only one factor.

The total amount of air releases from manufacturing are attributed to the following four types of emissions: fugitive, storage, secondary, and process. The amount each of these emission types contributes to the total amount of product releases is not known. However, this information has been calculated for VOC (volatile organic carbon) by IT Enviroscience (1980). Of the total amount of VOC emitted to the air from the synthetic organic chemicals manufacturing industry, 9 percent is attributed to storage losses, 32 percent to fugitive emissions, 4 percent to secondary releases, and 55 percent to process vent emissions. It can be assumed that the product emission breakdown will be similar to the VOC emission breakdown. Like the other factor, this emission breakdown is only an approximation and will vary among unit processes and manufacturing facilities.

(4) Emission Characteristics. The various components required to characterize air emissions are shown in Table 27. In addition, examples of emission characteristics are presented in Appendix C for the organic chemicals, plastics, and lubrication and hydraulic fluid industries. These characteristics are required as input values for ATM and other models.

There is no simple source that provides all the information on emissions characteristics. Several sources must be used and include but are not limited to: reports generated by OAQPS (Monitoring and Data Analysis Division, Strategies and Air Standards Division), EPA Industrial Process Profiles, EPA Compilation of Air Pollution Emissions Factors, State Emissions Inventory Questionnaires (EIQ), various trade journals, and various data bases. Reports on specific industries that characterize air emissions are shown in Table 28.

Table 26. Air Emission Factors Derived from Materials Balances

Chemical	Air emission factor (%)
Phenol	0.10
2-Chlorophenol	0.11
2,4-Dichlorophenol	0.10
Tetrachloroethene	0.80
Methylene chloride	0.20
Benzene	0.11
1,1,1-Trichloroethane	0.95
Ethylene dichloride	0.72
Di-n-butyl phthalate ester	0.011
Diethylphthalate ester	0.11
Bis(2-ethylhexyl)-phthalate	0.12
Trichlorofluoromethane	1.0
Trichloroethene	1.46
Toluene	0.11
Chloroform	0.048
Pentachlorophenol	0.07
Naphthalene	0.02
Ethylbenzene	0.10
Methyl Ethyl Ketone	0.10
Xylene	0.082
Acetone	0.10

Table 27. Parameters and Factors Required for Air Emission Characterization

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- Emissions categories: process, fugitive, storage and handling, etc.
- Contributions from each emissions category
- Stack information: height, diameter, number per plant, etc.
- Periodicity of release: batch, continuous, semi-continuous; frequency and duration
- Wastestream: exit velocity, exit temperature, chemical and physical composition, flow.

Table 28. Example of Publications Containing Emission Characteristics

Sources of information	Author/originating entity	Air	Comments
I. General documents			
Air pollution	Stern (1976)	X	Three-volume set containing treatment technologies used by industry and their efficiencies.
Human exposure to atmospheric concentrations of selected chemicals, Volumes 1 and 2	SAI (1981)	X	Exposure assessments on 35 chemicals being considered for listing under Section 112 of CAA; contains source releases to air.
Organic chemical manufacturing, Volumes 1-10	IT Enviroscience (1980)	X	Process descriptions for 52 organic chemicals, and their controlled and uncontrolled releases from manufacture.
Criteria documents	USEPA/OAQPS	X	Support documents for regulation of air standards; contain release data from industry.
New source performance standards	USEPA/OAQPS	X	Industry-by-industry descriptions; BACT limits described.
Background information documents	USEPA/OAQPS	X	Documents developed for selected pollutants considered for Section 111D for CAA; support documents contain source release data.
Control technology assessment of industries	NIOSH	X	Industry descriptions including release data and exposure for NIOSH chemicals (see Appendix C).
Industry documents	OSHA	X	Occupational descriptions including release.
Industry ventilation	Committee of industrial ventilation (1980)	X	Review of ventilation systems and pollutants they eliminate.
Compilation of air pollution emissions factors (AP-42)	USEPA (1977)		Lists air pollution emission factors for a number of processes and industries.
Evaluation of fugitive dust emissions from mining	Jutze et al. (1976)	X	Evaluation of mining dusts for several chemicals.
Exposure assessments for selected chemicals	OAQPS/SRI	X	Release data from sources is needed in order to do an exposure assessment.

The air quality data bases of primary concern that contain emission characteristics are: Aerometric Emission Reporting System (AEROS) and its subsets; Compliance Data System (CDS); Environmental Assessment Data Systems (EADS) and its subsets; and the Compliance Data System (CDS). These data bases should be consulted in the order listed above. A brief description of each system is presented below.

AEROS consists of several subsystems that provide emission characterization information. One of the subsystems, the National Emissions Data System (NEDS), contains data on the following relevant elements: stack height, stack diameter, gas temperature, gas flow rate, plume height, pollutant emission factors, design rate, capacity, control efficiencies, and operating level. The point source listing also includes name and address of the facility, SIC code, and source classification code (SCC). The SCC provides more detailed information than the SIC (example: SIC 2911 - Petroleum Refining; SCC 4-03-001-02 - Petroleum Storage, Fixed Roof Tank, Breathing Loss, Crude).

NEDS is an extensive data base but is limited with respect to statistical summary retrieval capabilities. For instance, it is not possible to retrieve average stack height for a given SIC. Therefore, retrieval of a sample of plants must be performed for industrywide exposure assessments and summary statistics need to be calculated by hand. The primary drawback of NEDS is that it is essentially limited to points emitting more than 100 tons per year of criteria pollutants (e.g., NOx, SO_2, particulates). As far as toxic substance releases are concerned, process vents and other points that are of most interest are not generally covered by NEDS. Two other important subsystems of AEROS are the Source Test Data System (SOTDAT) and the Hazardous and Trace Emissions System (HATREMS). SOTDAT contains the same information as NEDS but is limited to selected test facilities. HATREMS is also similar to NEDS except that it tracks facilities releasing noncriteria hazardous pollutants. While HATREMS and SOTDAT are potentially most applicable to exposure assessments on toxics, there are very little data in these systems yet so they are not widely useful.

CDS is a management information system that contains data on plants, factories, and other point sources of air pollution. Emissions characterization information includes compliance data, treatment levels, inspection data, and production levels of plants. Other information is similar to NEDS point source listing.

EADS consists of several subsystems that contain emission characteristics information based on the physical character of the emissions (i.e., gaseous, liquid, fine particle, solid, and fugitive).

This information includes design process rate, process type, stack height, mass/volumetric flow rate, stream velocity, and stream temperature.

Industry-specific date bases are also available and include Organic Chemical Producers Data Bases (OCPDB) and Multimedia Assessment of the Inorganic Chemicals Industry. An example of an OCPDB retrieval is presented in Appendix C, Exhibit C.1.7.

Detailed descriptions of the data bases mentioned above are provided in Appendix A. The information resource matrix at the beginning of the appendix presents an index and location for the data bases available in Appendix A.

Beyond these data bases, a vast amount of information on emission characteristics exists in EPA and contractor publications. One contractor's report in particular (SAI 1981), prepared for OAQPS, addressed 35 selected chemicals in respect to human exposure to atmospheric concentrations. An appendix was provided on each of 35 chemicals and contained detailed emission characteristics information including number of stacks, vent height, vent diameter, discharge temperature, velocity, and distribution area.

(5) Environmental Characteristics. Environmental characteristics used to model ambient concentrations include meteorological data and terrain data.

The best source of meteorological data is the computerized data file maintained by the National Weather Service at the National Climatic Center (NCC) at Asheville, North Carolina. The raw data in this file for 250 major meteorological reporting stations throughout the country can be processed by using the STability ARray (STAR) program to provide data on atmospheric stability, wind direction, and wind speed. STAR is available on magnetic tape from the NCC and is widely used by air modelers. In fact, ATM is interfaced with this program and the NCC raw data in the OTS operating model system. Users should be aware, however, that the Pasquill-Turner method used in the STAR program for calculating stability is a very indirect method, and may be inappropriate for modeling rough terrain, valleys, cities, and other areas with terrain anomalies (Sullivan and Shanoff 1981). Since most models are very sensitive to atmospheric stability, this parameter must be characterized as accurately as possible (Sullivan and Shanoff 1981).

Terrain data are not required inputs to any of the models discussed above, because these models generally assume level terrain. If this assumption is inappropriate, however, the confidence in the modeled ambient concentration is reduced. A qualitative evaluation of terrain roughness can be made for an area by referring to the U.S. Geological Survey (USGS) 1:250,000 map series, which include contour lines. If more resolution is needed, the USGS 7.5-minute quadrangles provide very sharp detail. These maps are available from USGS headquarters in Reston, Virginia, or from the map offices in Arlington, Virginia, or Denver, Colorado.

(6) Fate Process Data. Fate process data needed for modeling include degradation rate by hydroxyl radical, degradation rate by ozone, and particle deposition rate. Some general sources of information on physicochemical properties were listed in Table 1 (Section 2), but for the most part these sources do not include quantitative atmospheric rate data. The Environmental Fate Data Base (EFDB), currently under development by Syracuse Research Corporation for OTS, contains files of physicochemical properties, including oxidation reactions in the atmosphere. Three files are included in EFDB:

- DATALOG, a data pointer file, covering 2,600+ chemicals; 20,000+ records.
- CHEMFATE, a data value file, covering 220+ chemicals; 3,600+ records.
- XREF, a bibliography file, covering 1,900+ citations.

The files are searchable by Chemical Abstracts number. An example of an EFDB (CHEMFATE) retrieval is provided in Appendix C, Exhibit C.4-7.

A literature search via the commercially available computerized systems for the individual substance or analogous compounds may also yield rate data. Much of the data in the literature is found in periodicals such as Environmental Science and Technology, Journal of Physical Chemistry, and International Journal of Chemical Kinetics.

Another alternative is to use estimation techniques. Algorithms for estimating destruction by ozone or hydroxyl radical attack are currently programmed into ATM; one inputs the molecular structure, and based on component rates for various bonds (e.g., carbon-carbon double bond), a degradation rate is estimated.

ATM is also programmed to estimate particle deposition rate, provided that particle size spectrum is input. A routine for estimating particle size spectrum was discussed in Section 3.1.2.

(7) Model Execution. Model execution involves setting up the appropriate model, inputting the parameters discussed in subsections

6.2.3(2) to 6.2.3(6), and outputting ambient concentrations. For detailed instructions on model operation, the reader is referred to the following sources:

Model	Source (see reference section for complete citation)
GIOAP	Moschandreas et al. 1978
Line sources - UNAMAP	Smith et al. 1978
Atmospheric Box Model	Gifford and Hanna 1972
ATM	Patterson et al. 1981.

6.3 Dermal Exposure

Dermal exposure to humans differs from inhalation exposure because of the activities that lead to exposure; swimming in rivers, lakes, and streams is the only activity considered to cause significant dermal exposure. Although other activities (e.g., water skiing, fishing, standing in the rain) could lead to human dermal exposure, the frequency, duration, and amount of skin surface available for exposure are small; therefore, at least for general and long-term assessments, these activities are considered negligible. (Consult Scow et al. (1979) to evaluate their significance.) Because swimming is an episodic activity (unlike the continuous activity of breathing), it is necessary to consider frequency and duration (subsection 6.3.1) of exposure. In addition, availability of dermal surface area to the waterborne pollutant is an important factor in dermal exposure calculation (subsection 6.3.2). These activity-related parameters, when coupled with data on the aquatic ambient concentration (subsection 6.3.3), yield a dermal exposure figure as outlined earlier in Section 1.3.2.

6.3.1 Frequency and Duration

Frequency of outdoor swimming in natural surface water bodies must be determined in terms of the number of exposures per year. The duration parameter refers to the number of hours per exposure. Together, these parameters equal the exposure periodicity in hours per year.

The only information source found for frequency and duration of outdoor swimming was in a report by the Bureau of Outdoor Recreation (USDOI 1973). Of the surveyed population of 11,000, 34 percent swam in rivers, lakes, and oceans. For this group, the average frequency of swimming was seven days per year, and the average duration was 2.6 hours per day. It is not possible to disaggregate this into separate frequencies and durations for rivers, lakes, and oceans, but it is likely that lakes and oceans make up the majority of the time reported. It is important to note that the seven activity days were reported only during the three summer months, or summer quarter (of 1972). This can be considered an annual value with the assumption that most, if not all, outdoor swimming occurs only during that time of the year. This assumption is not realistic in the warmer areas of the country, but no better data were found.

In summary, for a national per person average:

- 34 percent of the total population swims outdoors in natural surface water bodies (including oceans, lakes, creeks, rivers).
- Frequency of exposure = 7 days/year.
- Duration of exposure = 2.6 hours/day.
- Periodicity = 18.2 hours/year.

These are general values; it should be noted that there is probably considerable geographic variability.

6.3.2 Availability

Availability for dermal exposure calculation is assumed to equal the total amount of human skin surface area. Availability values are given below for adults and children. If the exposed population will not be disaggregated by age groups, it is recommended that both availability values be used to represent a general range of exposure for the total swimming population. Both figures cited below are from ICRP (1974).

Availability:

- Average Adult (male and female, 20-30 yrs) = 17,000 cm^2.
- Average Child (male and female, 1-10 yrs) = 7,700 cm^2.

6.3.3 Ambient Aqueous Concentration

Like ambient air concentration for inhalation discussed in Section 6.2.3, ambient aqueous concentration can be determined by using monitoring data and/or by modeling. Monitoring data are generally rare, but some data sources have ambient toxic substances concentrations; these are discussed in Section 4.2.2. Most often, some modeling will be required. Generalized model requirements are listed in Table 29. The remainder of this section discusses modeling.

The steps involved are analogous to those addressed in Section 6.2.3 for modeling air pollutants. They are as follows:

1. Select model.
2. Locate receiving streams.

Table 29. Effluent Characteristics Needed To Model Aqueous Ambient Concentrations

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1. Discharge type -- point or nonpoint

2. Flow

3. For point sources, whether:

   direct (discharged after on-site treatment), or

   indirect (routed to publicly-owned treatment plant [POTW] for treatment)

4. Periodicity of release:

   continuous

   semi-continuous or batch (need frequency and duration of release)

---

3. Determine source strength.
4. Characterize effluent.
5. Characterize environment.
6. Analyze fate processes.
7. Execute the model.

Each of these elements is discussed below.

(1) Model Selection. Numerous models have been developed for estimating the effects of chemicals on water quality. A summary of models available for estimating pollutant concentrations in surface waters has been prepared in another volume of this report--Methods for Assessing Exposures from Drinking Water (Volume 5). The reader should refer to Table 8 in Volume 5 for complete listings, descriptions, and references to other models. The ensuing discussion is limited to those water models currently being used by OTS.

The simplest method of estimating ambient concentration is to assume immediate dilution and distribution of the substance at the point where it is discharged to surface water. The required data for this approach are the aqueous loading (mass/time) and the receiving stream flow (volume/time). This is obviously a gross method and cannot account for fate processes, but it is useful in screening-level studies where great accuracy is not required.

A much more sophisticated model is the EXposure Assessment Modeling System (EXAMS), which has been developed by USEPA's Athens Environmental Research Laboratory (ERL). EXAMS is a compartment model, i.e., it considers the fate and transport of a chemical as it passes through a series of water compartments and associated sediment and biotic compartments. Within each compartment, the model generates one concentration; it is assumed that each compartment is homogeneous. The compartments can be arranged to depict a simple pond (one water and one sediment compartment), a river (a series of water and sediment compartments), or a stratified lake (one upper water compartment and one lower water compartment). EXAMS can simulate chemical loading from point sources, atmospheric deposition (dry and wet), nonpoint sources, and groundwater seepage. Its use is limited to organic chemicals, i.e., it is not appropriate for inorganics.

EXAMS can depict not only bulk transport and dilution, but fate processes including volatilization, hydrolysis, photolysis, biodegradation, adsorption to suspended and bed sediments, and chemical speciation (Fiksel et al. 1981). Input requirements for EXAMS are listed in Table 30. Default values are available for virtually all of these parameters except the hydrological ones, and are supplied by the model.

Table 30. EXAMS Input Requirements

Parameter	Units
River and tributary flow	m^3/hr
Non-point source water input (direct surface runoff)	m^3/hr
Compartment length	m
Compartment width	m
Compartment surface area	m^2
Compartment depth	m
Compartment volume	m^3
Stream velocity	m/s
Chlorophyll concentration	mg/L
pH	—
pOH	—
Concentration on suspended sediment	mg/L
Percent organic carbon content of benthic and suspended sediment	—
Extinction coefficient	m^{-1}
Nonpoint source sediment input	kg/hr
Length for dispersive mixing	m
Eddy dispersivity	m^3/hr
Cross-sectional area of adjoining reaches	m^2

Table 30. EXAMS Input Requirements
(continued)

Parameter	Units
Interflow	m^3/hr
Reaeration rate coefficient	cm/hr
Wind speed over river	m/s
Rainfall	mm/month
Cloud cover	tenths
Evaporation loss	mm/month
Water temperature	°C
Sediment load	kg/hr
Latitude	degrees
Spectral irradiance	photons/cm^2/s /nm
Distribution function (ratio of optical path length to vertical depth in water)	—
Sediment density	g/cm^3
Percentage water weight of sediment	—
Cation exchange capacity of sediment	milli eq/100 g dry wt
Anion exchange capacity of sediment	milli eq/100 g dry wt
Molar concentration of oxidants	moles/L

Table 30. EXAMS Input Requirements
(continued)

Parameter	Units
Biomass in water and sediment	mg/L and g dry wt/m^2
Fraction of planktonic biomass	—
Biotemperature	°C
Bacterial density	cells/100 g dry wt
Percent of active bacteria	—
Dissolved organic carbon	mg/L

Source: Fiksel et al. 1981.

Typical values for many of the environmental characteristics listed in Table 30 are being developed under contracts with the Environmental Research Laboratory, Athens ORD, for 15 major river basins in the U.S. These studies should be completed sometime in late 1983 and will be available through NTIS. Kenneth F. Hedden (ERL/Athens) can be contacted for more current information at (404) 546-3310.

EXAMS outputs the steady-state concentrations of the chemical of interest (for dissociated and undissociated species) in each compartment (water, sediment, biota) and the decay kinetics. The model allows dynamic response to fluctuating loads of chemicals, but in most applications, loading is assumed to be constant.

The Wisconsin Hydrologic Transport Model (WHTM) is also in use by OTS. WHTM is a very "data-hungry" model suitable for detailed simulations of a specific locale. It is less suitable for more general applications. WHTM simulates the transport of organic or inorganic chemicals through soils and surface waters. Input requirements include loading rate (by deposition, incorporation into the soil, or direct point source discharge), environmental characteristics (flows, temperature, soil characteristics, precipitation, infiltration rates, suspended solids load, etc.), and reaction rates for fate processes. The model accommodates biodegradation, hydrolysis, aqueous photolysis, volatilization from soil and water, absorption to soils and sediments, and dissociation. Output is the concentration of the chemical in various compartments with temporal resolution as fine as 15 minutes.

(2) Receiving Streams. After selecting the appropriate model (Section 6.3.3(1)), the next step is to determine the exact location of any toxic pollutant discharges entering the receiving stream, i.e., surface waters. To determine the exact location of the discharges, the four steps below can be used:

1. Check the Industrial Facilities Discharge file (IFD).
2. If the required information is not in the IFD file, check the National Pollutant Discharge Elimination System (NPDES) data base.
3. If the exact discharge location could not be found from the above information sources, call the Regional EPA enforcement staff, who usually are aware of most major sources.
4. Call the company.

A more detailed description of Steps 1 and 2 is presented below:

Step 1. The IFD file is an EPA in-house data base consisting of direct and indirect discharges for the major industrial categories. It covers those industries suspected of discharging priority pollutants. This data base allows rapid selection, sorting, and retrieval of information based on a variety of selection criteria. For example, by selecting a specific SIC code, it is possible to output information on the corresponding industrial category. This output can be further refined by specifying a particular state, county, city, or river basin.

In general, two categories of selection criteria (identities) can be used to obtain location data. These two categories consist of location and manufacturing facility information. The specific identifiers found in each category are presented in Table 31.

Additional background information on the IFD file is located in Appendix A. Sample IFD retrievals are presented in Appendix C, Exhibits C.1-5, C.2-5, and C.3-5.

Step 2. NPDES is a permit-issuing program designed to monitor and control the discharge of pollutants into the nation's surface waters. Any industry or publicly owned treatment works that discharges into surface waters is required to obtain an NPDES permit.

This file is organized in a manner similar to that used for the IFD file. The identifiers are grouped according to location and facility information and are presented in Table 32.

For additional information on the NPDES file, see Appendix A.

(3) Source Strength. Source strength is equivalent to the environmental release rate to water and is expressed in units of mass/time (e.g., kg/day or kkg/yr). As is the case for air emissions, source strength to water can be determined by:

1. Monitoring
2. Performing environmental materials balance
3. Using estimating factors.

Monitoring

Monitoring data for aqueous discharges provide the most useful and accurate information, but they are not available for most toxic substances. Data bases providing aqueous loading rates are discussed in Section 4.1.2.

Table 31. IFD Location and Facility Identifiers

Location Identifiers	Facility Identifiers
1. State	1. Facility name
2. County	2. Facility location
3. City	3. Street address
4. Street address	4. SIC code
5. Coordinates	5. Dun and Bradstreet number
6. Latitude/longitude	6. NPDES number
7. Stream name	7. Program identifier
8. Stream reach	
9. River mile	

Besides location and facility information, the following nonpollutant parameters can be obtained from the IFD file:

- Discharge points
- Flow rates
- Geographic subdivisions
- Industry
- Political subdivisions
- Demographics

Table 32. NPDES Location and Facility Identifiers

Location identifiers	Facility identifiers
1. State	1. Plant facility name
2. City	2. Plant location
3. Town/township	3. NPDES number
4. Street address	
5. Project identifier NPDES number	

These identifiers are also possible output parameters and can be combined to further restrict the scope of the search.

Besides the above data, the following nonpollutant parameters can be obtained from the NPDES file:

- Compliance data
- Discharge points
- Flow rates
- Inspection data
- Sampling data

Environmental Materials Balance

A materials balance approach is often used to estimate releases to various environmental compartments. One of the components of a materials balance is identification of the points of release and associated loadings to the aquatic environment, usually on an annual basis.

Estimating Factors

If neither monitoring data nor materials balances information is available, a very crude approximation of release from production sites can be made by deriving relationships between production and release rate.

Estimating factors can be used to provide approximate data on water release from production. A water estimating factor indicates the approximate amount of product released to receiving streams (surface water) as a percentage of production volume. It cannot be overemphasized that estimating factors are only crude approximations; they should be used only when no other options are available.

An estimating factor was determined to account for the product releases to receiving streams from the manufacture of organic chemicals. This emission factor was determined by averaging the product water releases in over 20 organic chemical materials balances. A list of the materials balances considered and the water release factors are presented in Table 33.

The average value from Table 33 was found to be 0.40 percent (equivalent to 4 kg released per kkg produced) based on the available information. Again, this emission factor should be used with extreme caution. Actual emissions from organic chemical manufacturing are highly process- and site-specific and cannot be adequately estimated by only one emission factor.

(4) Effluent Characteristics. Information on effluent characteristics needed to model aqueous ambient concentrations is listed in Table 29. This information is available on an industrywide basis from the following sources: EPA Effluent Limitation Guidelines Development Documents; EPA Treatability Manuals, Best Available Technolgy (BAT) Review Studies, Environmental Data Summary and Analyses (EDSAs), Industrial Facilities Discharge file (IFD), and Bureau of Census (Census of Manufactures).

Industry coverage for the first three types of information sources noted above is listed in Table 34; presentation of the information varies from document to document. Examples of EDSAs providing industrywide flow

Table 33. Materials Balances and Water Emission Factors

Materials balance	Water emission factors (%)
Phenol	0.008
2-Chlorophenol	2.09
2,4-Dichlorophenol	2.10
Tetrachloroethene	NA
Methylene chloride	0.005
Benzene	0.01
1,1,1-Trichloroethane	NA
Ethylene chloride	NA
Di-n-butyl phthalate ester	0.13
Diethylphthalate ester	0.11
Bis(2-ethylhexyl) phthalate	0.13
Trichlorofluoromethane	NA
Trichloroethene	0.03
Toluene	NA
Chloroform	0.01
Pentachlorophenol	NA
Naphthalene	NA
Ethylbenzene	0.17
Methyl ethyl ketone	NA
Xylene	0.04
Acetone	NA
TOTAL	4.83

NA - Not available.

Table 34. Documents Describing Aqueous Effluent Characteristics for Industries Covered by the Clean Water Act

Major Industry	Development document[a]	EDSA or technical profile[b]	Treatability manual[c]	No. of plants discharging		
				Zero	Direct	Indirect
Adhesives and sealants	x	No				
Aluminum forming	x	No		0	49	52
Auto and other laundries	x	Yes	x	20,000	350	90,000
Battery manufacturing	x	Yes				
Coal mining	x	Yes	x	NA	6,000	0
Coil coating	x	Yes	x	0	36	54
Copper forming	x	No				
Electric and electronic components	x	Partial			2,000	8,000
Electroplating and metal finishing	x	Yes	x	200	2,932	6,586
Explosives manufacturing	x	No	x	100	180	0
Foundries	x	Yes	x	450	1,050	498
Gum and wood chemicals	x	No	x	3	14	6
Inorganic chemical manufacturing	x	Partial	x	0	630	120
Iron and steel manufacturing	x	Yes	x	220	1,405	238
Leather tanning and finishing	x	Yes	x	1	18	170
Mechanical products manufacturing	x	No				
Nonferrous metals manufacturing	x	Ongoing	x	215	129	79
Ore mining	x	Yes	x	NA	750	0
Organic chemicals manufacturing	x	Ongoing	x			
Paint and ink formulation	x	Yes	x	845	4	1,211
Pesticides	x	Yes				
Petroleum refining	x	Ongoing	x	55	182	48
Pharmaceutical preparations	x	No	x	134	50	245
Photographic equipment and supplies	x	Ongoing				
Plastic and synthetic materials manufacturing	x	No	x			
Plastic processing	x	No				
Porcelain enameling	x	Yes	x	0	30	100
Printing and publishing	x	Not regulating				
Pulp and paperboard mills	x	Yes	x	55	359	230

Table 34. Documents Describing Aqueous Effluent Characteristics for Industries Covered by the Clean Water Act (continued)

Major Industry	Development document[a]	EDSA or technical profile[b]	Treatability manual[c]	No. of plants discharging		
				Zero	Direct	
Indirect						
Rubber processing	x	No	x	100	1,054	504
Soap and detergent manufacturing	x	Not regulating	x	unknown	10	535
Steam electric power plants	x	Yes	x	10	1,050	100
Textile mills	x	Ongoing	x	0	239	926
Timber products processing	x	Yes	x	363	15	49
Publicly owned treatment works	x		x			

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[a] Development documents are prepared by EGD/OWWM/USEPA.

[b] Technical Profiles or Environmental Data Summary Profiles (EDSA) are prepared by MDSD/OWWM/USEPA; these contain confidential information and can only be accessed by EPA personnel.

[c] The treatability manual is a five-volume set which discusses water treatment of each industry, treatment technologies, and their removal efficiencies. It is cited in the bibliography as USEPA (1980b).

and direct/indirect discharge data are provided in Appendix C as Exhibits C.1-4, C.2-4, and C.3-4 for the organic chemicals, plastics, and lubricant and hydraulic fluids industries, respectively.

The IFD file can provide summary retrievals listing flows and number of plants discharging directly or indirectly; to provide this, the file must be searched by SIC (Standard Industrial Classification) code. SIC code may not correspond exactly to the specific industrial category or subcategory of interest, so this is a potential drawback.

The Census of Manufactures (Bureau of the Census 1980a) provides an industry-by-industry listing of water use. Use is grouped by such characteristics as process, cooling, refrigeration, drinking, etc., and is also broken out by direct or indirect discharge. Examples of Census of Manufactures data on organic chemicals, plastics, and lubricant and hydraulic fluids industries are presented in Appendix C as Exhibits C.1-1, C.2-1, and C.3-1, respectively.

For effluent characteristics for individual plants, there are two options:

1. Obtain an IFD retrieval for the plants.
2. Infer the characteristics based on industrywide data from the other information sources above.

IFD can be accessed by plant name. IFD retrievals showing flows and other effluent characteristics for specific plants are shown in Appendix C as Exhibits C.1-5, C.2-5, and C.3-5.

If IFD is not available, one of the other sources can be used. These other sources are designed to obscure plant-specific data to discourage calculation of confidential information. One can estimate the plant's effluent characteristics based on the industry average values or if production volume is known, flow may be calculated based on flow-production ratios provided in some of the effluent guideline development documents.

For nonpoint sources, effluent characteristics will be related to land use and hydrology. Land use data may be available from local planning agency studies mandated by Section 208 of the Clean Water Act. Watershed boundaries can be found in U.S. Geological Survey State Hydrologic Unit Maps (available from USGS offices in Reston, Virginia; Arlington, Virginia; and Denver, Colorado) which are arranged by a hydrologic unit code for regions, subregions, accounting units, and cataloging units. There are 352 accounting units in the U.S., and within these there are approximately 2,100 cataloging units. Data on annual runoff rates are available for each of the 18 major river basins in the U.S. from a USEPA draft report on the National Urban Runoff Program (DON 1981). Other useful hydrological information is found in the "Water Atlas of the U.S." (Geraughty et al. 1973).

(5) Environmental Characteristics. All models, including the simple dilution calculation, require data on the flow of the receiving stream. Beyond that, the EXAMS and WHTM models can use site-specific data on parameters that affect fate and transport or they can be run using model-supplied default values.

The U.S. Geological Survey maintains a system of stream gages throughout the U.S. to determine flow. Stream flow data can be accessed manually by referring to the USGS reports published annually on a state-by-state basis (e.g., "Water Resources Data for Virginia, Water Year 1980"). Locations of gaging stations are provided in a map in the front of each report, and average, high, and low flows are summarized for each station on an annual basis and over the period of record. Daily flows are provided, allowing calculation of seasonal averages (if needed).

More sophisticated hydrologic statistics can be computed by using the USEPA STOrage and RETrieval (STORET) Flow Data File (FDF). This file uses the USGS flow data (stored in computer form in Water Data Storage and Retrieval Systems (WATSTORE), and interfaced with STORET) and provides the programming required to calculate probability-based hydrologic values (e.g., 7-day, 10-year recurrence interval, low flow). Where the site involved is far from a USGS gaging station, the EPA GAGE file (Stream Gaging Inventory) can be used. This file includes data from additional sources such as state gages, U.S. Army Corps of Engineers gages, Bureau of Reclamation gages, etc. Like FDF, GAGE is maintained and operated by the Water Quality Analysis Branch, Office of Water Regulations and Standards, USEPA.

Where several locations are being studied, the REACH file of STORET offers an effective way of identifying environmental characteristics and monitoring data. If the locations correspond to the occurrence of various industrial facilities or publicly owned treatment works, selected plants or the entire industry (by SIC) can be located using the Industrial Facilities Discharge (IFD) component of REACH. Flows for each stream segment (i.e., reach) can be summarized by using GAGE, which is also a component of REACH.

Relevant water quality characteristics (e.g., pH, suspended solids) can be accessed by the main STORET Water Quality File which is interfaced with the REACH file, and the locations of drinking water intakes can be identified using the REACH Drinking Water Supply File. Thus, the REACH file links several types of data needed for modeling. Currently, several of the files in REACH are incomplete with respect to coverage of industrial plants and locations of drinking water intakes.

(6) Fate Process Data. Resources for fate process data were discussed previously in Sections 2 and 3 (see Table 2). These resources, which include empirical data, literature estimates, and general methods for estimating properties, can be consulted to provide the required partitioning, degradation, and kinetic data. Empirical data are preferred over estimates. If one or two processes are much faster or account for much more of the mass than the others, the other processes can usually be neglected, and the input data for them are not required.

(7) Model Execution. Model execution entails inputting the data listed in Subsections 6.3.3(2) to 6.3.3(6), calibrating with ambient monitoring data (when available), and outputting ambient concentrations. The dilution calculation is expressed by a simple mathematical equation:

$$C_d = \frac{C_e \cdot Q_e + C_u \cdot Q_u}{Q_e + Q_u}$$

where C_d = concentration downstream of the effluent

C_e = concentration in the effluent

C_u = concentration upstream of the effluent

Q_e = flow of the effluent

Q_u = flow of the receiving stream upstream of the effluent.

The term C_u is often considered to equal zero unless there are other sources upstream. If the nearest gaging station is downstream instead of upstream, the following assumptions are often made:

$Q_u + Q_e \sim Q_d$, or if
$Q_e << Q_u$, $Q_u = Q_d$, where Q_d = flow downstream.

These assumptions are applicable only if there are no major tributaries between the discharge point at the downstream gaging station.

Steps for execution of EXAMS and WHTM are provided in their respective user's manuals, by Burns et al. (1979) and Patterson et al. (1981).

6.4 Exposure of Aquatic Biota

Exposure of aquatic biota is usually analyzed in terms of aqueous concentration. Ambient concentration is derived by the process explained in Section 6.3.3, using monitoring data and/or models. The output should be a description of the concentration gradient at various distances downstream from the source. The distances will depend on the persistence of the substance being studied, the hydrology of the system, and the source strength.

Knowing the periodicity of releases into the aquatic environment is helpful when one compares calculated exposures to laboratory-generated toxicity tests of known duration. For example, if a fish is harmed by a 10-ppm concentration in a 24-hour flow-through bioassay, there is no reason to believe that it will be harmed by 1-ppm over a 10-day period under field conditions. Most often, the exact periodicity of releases is unknown and release is assumed to occur evenly and continuously; in these cases, the periodicity of exposure is continuous. Where the temporal release patterns are known more exactly from a detailed source characterization (not described in this volume), the exposures can be modeled separately for various release levels.

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APPENDICES

APPENDIX A

Information Resource Matrix

This appendix, an information resource matrix, catagorizes and briefly describes currently available information/data resources pertinent to the methods for assessing exposure to chemical substances, particularly these methods for the ambient, occupational and disposal scenarios.

In addition to the actual matrix, brief descriptions have been composed for each of the resources listed and are included in this appendix in the order in which they appear in the matrix. The descriptions have been designed to merely provide insight and guidance with regard to any particular resource; they have been intentionally abbreviated to reduce the volume of the appendix. The page where each information resource description appears is indicated in the first column of the matrix.

This information resource matrix is not intended to be all-inclusive in its coverage. Rather, it reflects a group of resources known to be applicable to the exposure assessment methods used by OTS.

The matrix presents 77 information resources that include:

- computerized data bases
- bibliographic retrieval systems
- nonbibliographic retrieval systems
- standard reference manuals
- encyclopedias, books, and special studies

These information resources are grouped into nine generalized categories arranged vertically on the matrix:

- chemical information
- air emissions
- water discharges
- waste disposal

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- ambient air
- ambient water
- bibliographic
- occupational resources
- miscellaneous

Information resources listed under each of the nine generalized categories are alphabetized.

Descriptive parameters, arranged horizontally on the matrix, are grouped into five generalized categories:

- exposure framework
- frequency of update
- period of record
- access
- responsible agency

The exposure framework category includes eight headings: physical/chemical properties; production and import; use, transport, export, and disposal; geographic distribution; environmental releases; emissions characteristics; environmental fate/pathways; and ambient concentrations. Strictly for the purposes of this appendix, each heading can be explained as follows.

Physical/Chemical Properties include molecular weight, ambient phase, density, boiling point, melting point, vapor pressure, solubility, acid dissociation constant, vapor density, partition coefficient, and half-life.

Production and Import includes sources, volumes, and process technologies. All tiers or levels of production may be included.

Use, Transport, Export, and Disposal include trade, commercial, and consumer market activities and distributions; sources; volumes; modes of transport; and techniques for disposal. Other parameters necessary for materials balance analysis are included here.

Geographic Distribution includes street address, county, state, region, hydrologic unit, latitude/longitude, etc.

Environmental Releases include air emissions, water discharges, or other pollutant releases from production; use, transport, disposal, and other activities.

Emissions Characteristics include stack height, exit velocity, plume rise, periodicity, wastestream composition, etc.

Environmental Fate/Pathways include photolysis, oxidation, hydrolysis, volatilization, sorption, biotransformation, bioaccumulation, and chemical speciation. Exposure pathways must also be addressed and include ambient loading, persistence, frequency and duration, and receptor populations.

Ambient Concentrations includes monitoring data for all ambient media including studies focusing on waste disposal and occupational area monitoring.

The frequency of update category includes five headings: continuous; periodic; annual; two to four years; and, five or more years. This category is concerned mostly with the computerized files; however, update frequency can be applied to some hard copy resources such as special reports or yearly surveys.

Continuous updating refers to weekly, daily, or hourly additions of data as well as master file update.

Periodic updating refers to monthly, quarterly, or irregular data additions and master file update. Irregular updating includes updates controlled by budgetary constraints, or data collected on an "as needed" basis.

Annual updating refers to yearly data additions and master file update. Some continuously and periodically updated resources are also updated on a yearly basis.

Two to four year updating and five years or more updating usually apply to special surveys and reports.

A source with no bullet in this category indicates that data collection and/or data update has been terminated, in the case of computerized files; or in the case of hard copy (books), only one edition has been published.

The period of record category includes four headings: five years or more; two to four years; one year or less; and special study. The category refers to length of data collection for computerized files, length of publication for hard copy resources, or one time special surveys/studies.

The access category includes three headings: hard copy, computerized, and manual file. This category refers to the nature and accessibility of the information resources. Hard copy denotes books, journals, reports, etc., as well as microfilm/microfiche.

The responsible agency category includes acronyms of the office, agency, or firm responsible for generating and/or maintaining the information resources. The following table is included as a key to the acronyms.

Key to Responsible Agency Acronyms

APTIC	Air Pollution Technical Information Center
BLS	Bureau of Labor Statistics
BRS	Bibliographic Retrieval Services
CDC	Control Data Corporation
CDS	Chemical Data Services
CMA	Chemical Manufacturers Association
CMH	Considine (author) - McGraw Hill
CPSC	Consumer Products Safety Commission
CSC	Computer Sciences Corporation
DIALOG	DIALOG Information Retrieval Service
EGD	Effluent Guidelines Division
EMSL	Environmental Monitoring System Lab - RTP
ERLA	Environmental Research Lab - Athens
ERLD	Environmental Research Lab - Duluth
FKCWI	Faith, Keyes, and Clark (authors) - Wiley Interscience
HWTF	Hazardous Waste Task Force
IERL	Industrial Environmental Research Lab - RTP
IERLC	Industrial Environmental Research Lab - Cincinnati
KOWI	Kirk-Othmer (authors) - Wiley Interscience
KVVNR	Karel Verschueren (author) - Van Nostrand Reinhold
MACSD	M/A-COM Sigma Data
MDSD	Monitoring and Data Support Division

Key to Responsible Agency Acronyms

NFPA	National Fire Prevention Association
NIOSH	National Institute of Occupation Safety and Health
NLM	National Library of Medicine
NSF	National Science Foundation
OAQPS	Office of Air Quality Planning and Standards
OHS	Occupational Health Services
OPMO	Office of Program and Management Operation
OPP	Office of Pesticide Programs
OPTS	Office of Pesticides and Toxic Substances
OPTSE	Office of Pesticides and Toxic Substances Enforcement
ORD	Office of Research and Development
OSW	Office of Solid Waste
OTS	Office of Toxic Substances
OWE	Office of Water Enforcement
OWPO	Office of Water Programs Operations
PCMH	Perry and Chilton (authors) - McGraw Hill
PIIC	Pergamon International Information Corporation
RED	Regional Enforcement Divisions
SDC	Systems Development Corporation
SRI	SRI International
SSED	Stationary Source Enforcement Division
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
USITC	U.S. International Trade Commission

			EXPOSURE FRAMEWORK								FREQUENCY OF UPDATE					PERIOD OF RECORD				ACCESS			RESPONSIBLE AGENCY
Page	Acronym	Information Resource	phys./chem. properties	production, import	use, transport, export, disposal	geographic distribution	environmental releases	emissions characteristics	environmental fate/pathways	ambient concentrations	continuous	periodic	annual	2 - 4 years	5 years or more	5 years or more	2 - 4 years	1 year or less	special study	hardcopy	computerized	manual file	
CHEMICAL INFORMATION																							
128	CEH	Chemical Economics Handbook		●	●	●						●	●			●				●	●		SRI
129	-	Chemical Engineer's Handbook	●		●			●								●				●			PCMI
131	CFCP	Chemical Formul. of Comm. Prod.		●	●	●						●							●	●	●	●	CPSC
132	CIS	Chemical Information System	●	●	●	●			●	●	●		●			●					●		CSC
137	CPD	Chemical Plant Data		●	●	●							●			●				●	●		CDS
138	-	Chemical & Proc. Tech. Encyclo.	●	●	●			●								●				●			CMI
140	CSIN	Chemical Substance Info. Network	●	●	●	●			●	●	●					●					●		OPTS
144	CHEMTREC	Chemical Transport. Emerg. Cent.			●							●				●			●			●	CMA
145	CICIS	Chemicals in Commerce Info. Sys.		●	●	●						●						●	●		●		OTS
147	DERMAL	Dermal Absorption Data Base							●		●					●					●		OTS
148	DCP	Directory of Chemical Producers		●		●						●	●			●				●			SRI
149	-	Encyclo. of Chemical Technology		●	●							●				●				●			KDHI
150	CHEMFATE	Environmental Fate Data Base	●						●	●		●							●		●		OTS
151	ERSS	Establishment Regist. Supp. Sys.		●		●						●	●			●					●		OPTSE
152	-	Handb. Env. Data on Org. Chem.	●				●	●	●							●				●			KVVNR
154	-	Industrial Chemicals	●	●	●											●				●			FKCWI
156	ISHOW	Info. Sys. on Haz. Org. in Water	●	●		●			●			●				●					●		ERLD
158	-	Multimed. Ass. Inorg. Chem. Ind.		●	●	●	●	●								●			●		●		IERLC
159	NFPA	Natl. Fire Prev. Hazard. Chem.	●		●							●							●	●			NFPA
160	NSF-HCL	Natl. Sci. Found. Hazard. Chem.					●					●							●	●			NSF
161	OHS	Occup. Health Serv. HAZARDLINE	●		●				●		●						●				●		OHS
165	OCPDB	Org. Chem. Producers Data Base		●	●	●		●				●	●			●					●		IERLC
168	PDMS	Pesticide Docum. Management Sys.		●	●	●	●			●	●						●				●	●	OPP
170	-	Pesticide Use Survey			●	●									●	●			●		●		USDA
171	SYNORG	Synthetic Org. Chem. Producers		●		●							●			●				●			USITC

Page	Acronym	Information Resource	EXPOSURE FRAMEWORK								FREQUENCY OF UPDATE					PERIOD OF RECORD				ACCESS			RESPONSIBLE AGENCY
			phys./chem. properties	production, import	use, transport, export, disposal	geographic distribution	environmental releases	emissions characteristics	environmental fate/pathways	ambient concentrations	continuous	periodic	annual	2-4 years	5 years or more	5 years or more	2-4 years	1 year or less	special study	hardcopy	computerized	manual file	
AIR EMISSIONS																							
173	AERUS	Aeromet. & Emis. Reporting Sys.		●		●	●	●		●		●				●				●	●		APTIC
175	CDS	Compliance Data System		●		●	●					●				●				●	●		SSED
176	EDS	Energy Data System				●		●								●					●		OAQPS
177	EADS	Environ. Assessment Data System		●		●	●	●		●		●	●			●				●	●		IERL
181	REIS	Region. Environ. Info. System		●		●	●			●		●	●			●					●		CDC
WATER DISCHARGES																							
183	DCP	Data Coll. Port. Ind. Waste Dis.		●	●	●	●	●				●				●						●	EGD
184	HISLIB	GC/MS Screen. Anal. Data Base					●					●					●				●		ERLA
185	IFD	Indust. Facil. Discharge File				●		●				●					●				●		MDSD
187	NPDES	Natl. Poll. Discharge Elim. Sys.				●	●	●				●	●			●					●	●	RED
188	NURP	Nationwide Urban Runoff Program				●	●	●		●		●					●		●	●	●		OWPO
189	PCS	Permit Compliance System				●	●	●				●				●					●		OWE
190	-	Verification Data Base				●	●					●					●		●		●		EGD
WASTE DISPOSAL																							
92	FFIS	Federal Facilities Info. System			●	●	●			●		●	●			●				●	●		OPMO
193	HWDMS	Hazard. Waste Data Manage. Sys.		●	●	●	●						●			●					●		OSW
195	STS	Hazard. Waste Site Track. System			●	●						●					●				●		HWTF
196	SEAS-RES	Strat. Env. Ass. Sys.-Residuals		●	●	●	●	●			●	●				●					●		ORD
197	-	Waste Characterization Data Base		●	●	●	●					●					●		●			●	OSW

Page	Acronym	Information Resource	EXPOSURE FRAMEWORK								FREQUENCY OF UPDATE					PERIOD OF RECORD				ACCESS			RESPONSIBLE AGENCY
			phys./chem. properties	production, import	use, transport, export, disposal	geographic distribution	environmental releases	emissions characteristics	environmental fate/pathways	ambient concentrations	continuous	periodic	annual	2 - 4 years	5 years or more	5 years or more	2 - 4 years	1 year or less	special study	hardcopy	computerized	manual file	
AMBIENT AIR																							
199	CHAMP	Commun. Health Air Monit. Prog.				●	●	●	●	●						●			●	●	●		EMSL
200	-	Field Study Measurements				●	●			●		●					●		●		●		ESRL
201	IPMN	Inhal. Partic. Monitor. Network				●		●		●		●					●				●		EMSL
202	FBANK3	Natl. Air Monitoring System				●		●		●		●	●			●				●	●		EMSL
203	NASN	Natl. Air Surveillance Network				●				●						●					●		ESRL
204	-	Pesticides in Ambient Air				●		●	●	●			●			●						●	OTS
205	SAROAD	Stor. & Retr. of Aeromet. Data				●				●	●	●				●				●	●		APTIC
AMBIENT WATER																							
207	-	Basic Water Monitor. Core Stat.				●				●		●					●			●	●		MDSD
208	NASQAN	Natl. Stream Qual. Acc. Network				●				●		●				●				●	●		USGS
209	NSWMP	Natl. Surface Water Monit. Prog.				●			●	●		●				●					●		OTS
210	NWQSS	Natl. Water Qual. Surveil. Sys.				●				●		●					●			●	●		MDSD
211	REACH	River Reach File				●	●					●							●		●		MDSD
212	STORET	Stor. & Ret. of Water Qual. Data				●	●	●	●	●	●	●	●			●					●		MDSD
218	GAGE	Stream Gage Inventory File				●						●	●			●					●		USGS
219	WATSTORE	Water Data Stor. & Retr. System				●				●	●	●	●			●					●		USGS
221	-	Water Quality				●				●						●					●		ESRL
BIBLIOGRAPHIC																							
223	BRS	Bibliographic Retrieval Services	●	●	●	●			●		●					●					●		BRS
225	DIALOG	Lockheed DIALOG Info. Ret. Serv.	●	●	●	●			●		●					●					●		DIALOG
231	MEDLARS	Medical Liter. Anal. & Ret. Sys.	●						●		●					●					●		NLM
234	INFOLINE	Pergamon Internatl. Info. Corp.	●	●	●	●			●		●					●					●		PIIC
237	ORBIT	System Development Corp. ORBIT	●	●	●	●			●		●					●					●		SDC

Page	Acronym	Information Resource	EXPOSURE FRAMEWORK								FREQUENCY OF UPDATE					PERIOD OF RECORD				ACCESS			RESPONSIBLE AGENCY
			phys./chem. properties	production, import	use, transport, export, disposal	geographic distribution	environmental releases	emissions characteristics	environmental fate/pathways	ambient concentrations	continuous	periodic	annual	2-4 years	5 years or more	5 years or more	2-4 years	1 year or less	special study	hardcopy	computerized	manual file	
OCCUPATIONAL RESOURCES																							
242	-	Ann. Occup. Inj. & Illness Surv.				●	●						●			●					●	●	BLS
246	-	Cross Sectional Industry Studies				●	●	●		●		●				●			●	●			NIOSH
247	HEEDB	Health Effects Eval. Data Base				●	●			●				●			●		●	●			NIOSH
248	NOHS	Natl. Occup. Hazard Survey				●	●	●						●			●		●	●			NIOSH
249	OHER	Occup. Hazard Expos. Registry				●	●	●				●				●			●			●	NIOSH
250	-	Occup. Relat. Disease Case Reg.				●	●	●				●				●			●	●			NIOSH
251	-	Outcome Stud. Work. Sel. Indust.				●	●	●				●				●			●	●			NIOSH
252	BLS-SRS	Statistical Recordkeeping System				●	●	●					●			●				●			BLS
MISCELLANEOUS																							
254	BOC	Bureau of Census Data Files		●	●	●						●	●			●					●	●	BOC
256	DATAGRAF	M/A-COM Sigma Data DATAGRAF		●	●	●	●			●		●				●					●		MACSD
257	NEISS	Natl. Electronic Inj. Surv. Sys.					●		●			●	●				●			●			CPSC
258	PIMS	Pesticide Incident Monitor. Sys.		●	●	●	●		●	●	●					●				●	●		OPP
259	SWEMS	Soil Water Estuarine Monit. Sys.				●	●		●	●		●	●			●				●	●		OTS
260	VAX	VAX Computer Data Bases				●	●	●	●	●		●				●					●		OTS

CHEMICAL INFORMATION RESOURCES

CEH

Scope:

The Chemical Economics Handbook (CEH) is a multi-volume loose-leaf book concerned with the economic status and progress of the world's chemical industries. Participants (subscribers) are kept informed regarding the present and future status of raw materials, primary and intermediate chemicals, chemical product groups, the chemical industry, and those aspects of other industries and the total economy that are relevant to the chemical industry. Emphasis is placed on future markets, both in terms of quantities and economies of chemicals produced/consumed and the technological requirements of future demand.

Sections of the CEH are: Introduction; Index; Economic Indicators; Manual of Current Indicators; Industry; Chemicals. The main body of CEH is made up of Reports and Data Sheets concerning individual chemicals or groups of chemicals. Data Sheets are summaries including data on chemical production, sales, consumption, price, manufacturing processes, producing companies, plant locations, plant capacities, imports, exports, and sources used. Yearly growth rates can be extrapolated and compared using the standardized graphs and a special protractor, included with each CEH set.

Reports contain detailed analytical sections on topics covered by Data Sheets. CEH Reports are written by subject specialists and reviewed by collaborating experts in the chemical industry, market researchers, or product managers.

A "Manual of Current Indicators" section reporting recent economic statistics is updated and reissued every other month.

CEH contains chemical industry economic indicators such as product growth curves, production quantities, inventory data, price, and export/import ratios. Plant locations, capacities and other data are gathered and updated occasionally. Specialized volumes deal with specific industries such as pesticides.

Access:

CEH is available from SRI International, Menlo Park, CA.

Cost:

Hard copy is available for $7,500-9,000 depending on the number of specialized volumes desired. Computer tape with data listed therein are available. Monthly indexes for the main body of the handbook and for the specialized volumes are available at a subscription cost.

Chemical Engineers' Handbook

FIFTH EDITION

Prepared by a staff of specialists
under the editorial direction of

Robert H. Perry
Consultant

Cecil H. Chilton
Senior Advisor
Battelle Memorial Institute

McGRAW-HILL BOOK COMPANY
New York St. Louis San Francisco Auckland Bogota
Dusseldorf Johannesburg London Madrid Mexico
Montreal New Delhi Panama Paris São Paulo
Singapore Sydney Tokyo Toronto

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CFCP

Scope:

The Chemical Formulations of Consumer Products (CFCP) database contains formulation (ingredients with percentage) information for over 15,000 U.S. consumer products.

Data were collected directly from over 1600 manufacturers required to report ingredients to a specificity 0.1%. Approximately 45% of the product formulations were designated by the manufacturers as proprietary data or trade secrets.

Data Files:

The database consists of four files: A Manufacturer-Product file containing manufacturer names, codes, and addresses; a Product-Ingredient file containing product names, codes, and formulation data; a Chemical Dictionary file which is a name authority file relating Chemical Abstracts Service Registry Numbers and nomenclature to trade names and other chemical names reported by manufacturers; and a Bookkeeping file containing file status and management data.

Access:

The file is accessible through the staff of the Consumer Product Safety Commission, Bethesda, MD.

Cost:

Searches are free, as are some publications. Extensive searches may involve some cost.

Update:

No longer named CFCP. Now named CHIP1 and CHIP2 (CHemicals In Products). Majority of information is proprietary. Other requests possible through FOI (Freedom of Information) channels. For further information contact:

Eliot Foutes, CPSC - Economics Division, (301) 492-6962.

The NIH/EPA Chemical Information System CIS

In 1970, work was begun at the National Institutes of Health (NIH) to determine the feasibility of online, interactive searching of numeric, chemical data bases. The first area to be studied was mass spectrometry, and in 1972, a search system and a mass spectral library of approximately 10,000 spectra were developed as a joint effort between NIH and the U.S. Environmental Protection Agency (EPA). This permitted searches for compounds whose mass spectra possessed specific peaks and also for the mass spectra of compounds having specific molecular formulas or molecular weight.

Since then, a number of other numeric data bases and search systems have been developed with much the same design. These components cover areas that reflect the missions of the various supporting agencies of the U.S. Government, such as carbon-13 nmr, X-ray diffraction, toxicity and regulation of chemicals.

As the various CIS data bases were being developed and merged into the public system, work was continuing at NIH and EPA upon the problem of searching these data bases for specific chemical structures or substructures. This led in 1978 to the releases of a Structure and Nomenclature Search System (SANSS), which permits searching through any or all of the data bases of the CIS for particular chemical structures or substructures.

CIS information is referenced on the SANSS data base in which every chemical substance in the CIS is represented. SANSS is used to identify a chemical substance, given its Chemical Abstracts Service (CAS) Registry number, its name, or its structure, and refers the user to all CIS files that contain data on the compound. Any such data can then be retrieved with simple commands from the appropriate file or the CIS network.

Several new data bases are in process and will be added to CIS as soon as development and testing are completed. These include:

CHEMLAW
CESARS
CHRIS

Information on new additions and enhancement of existing data bases will be announced through the Newsletter and NEWS messages available online in CIS.

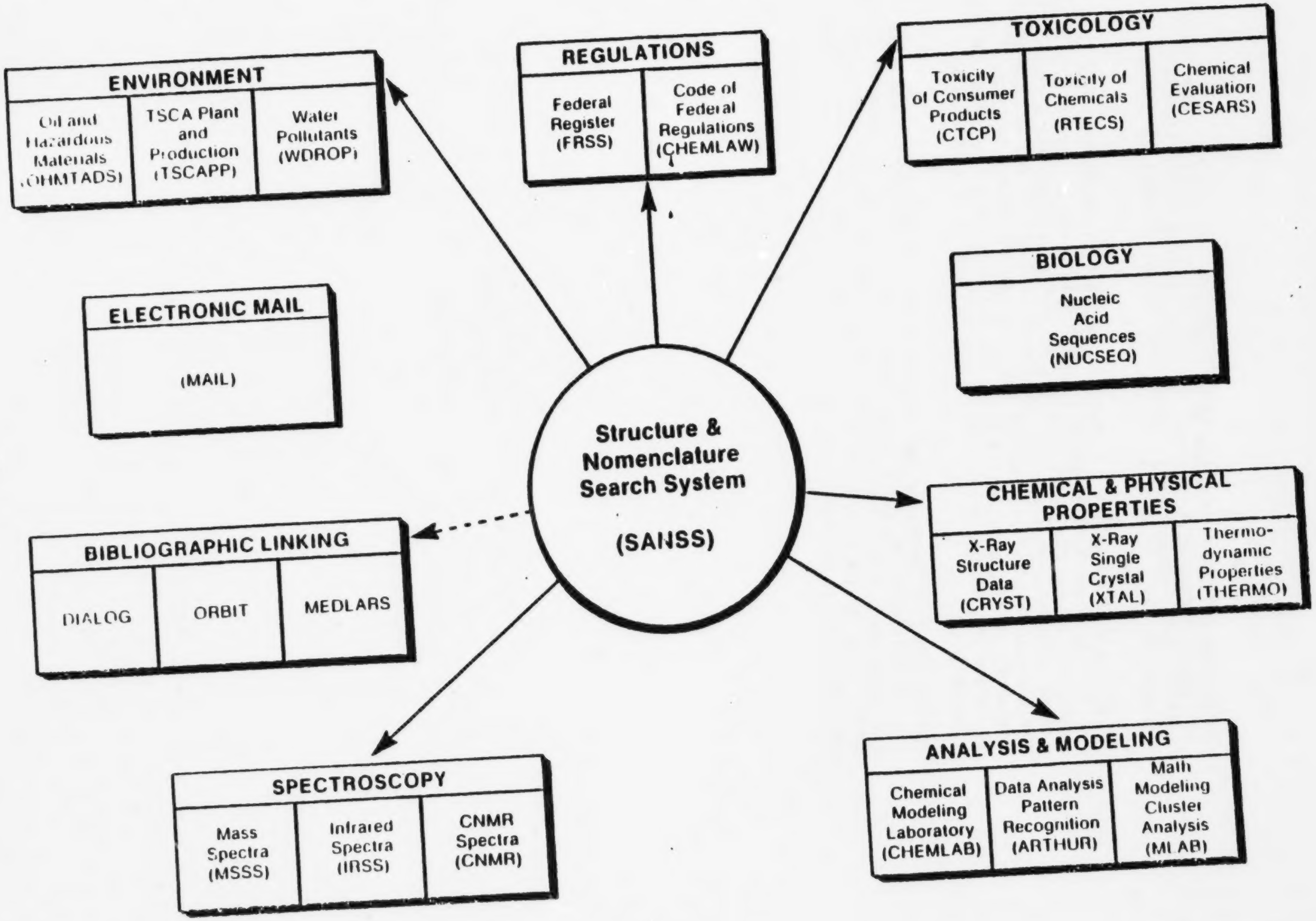
The retrieval information from one component to another may easily be done. The commands which allow this are known as UNIVERSAL commands. Thus, a name search in SANSS may reference the CIS Mass Spectral Search System (MSSS) and/or the NIOSH Registry of Toxic effects of Chemical

Substances (RTECS). From the SANSS component, the NSHOW or the TSHOW universal command will retrieve the mass spectrum or the NIOSH/RTECS toxicity data, respectively. After retrieving the data the SANSS search software is still in effect.

If your aim is to identify a chemical substance from measurements made on it, such data can be entered interactively into any of the numeric data components of the CIS, such as MSSS, or another appropriate system. The search strategies in these CIS components will assist you in identifying the unknown material and the CAS Registry numbers of any matching compounds will be provided to you. The Registry number can then be used to locate information pertaining to the compound in any other CIS component.

The CIS has been developed and maintained by Fein-Marquart Associates, Inc. of Baltimore, Maryland under contract to cooperating Agencies of the U.S. Government and is available in the private sector for use by the public on a fee-for-service basis. It is accessible world-wide through the GTE-Telenet and Tymnet telecommunications networks.

CIS COMPONENTS
WINTER. 1982



ENVIRONMENT
Oil and Hazardous Materials (OHMTADS)
TSCA Plant and Production (TSCAPP)
Water Pollutants (WDROP)
REGULATIONS
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(SANSS)
CHEMICAL & PHYSICAL PROPERTIES
X-Ray Structure Data (CRYST)
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BIBLIOGRAPHIC LINKING
DIALOG
ORBIT
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SPECTROSCOPY
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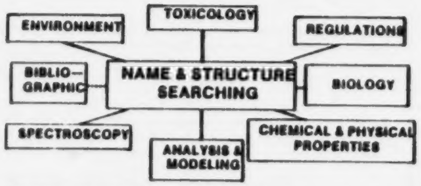
CNMR Spectra (CNMR)
ANALYSIS & MODELING
Chemical Modeling Laboratory (CHEMLAB)
Data Analysis Pattern Recognition (ARTHUR)
Math Modeling Cluster Analysis (MLAB)

CHEMICAL INFORMATION SYSTEM

The Chemical Information System is a collection of scientific and regulatory databases as well as data analysis computer programs. It contains numeric data (as opposed to bibliographic information) in the areas of toxicology, environment, regulations, spectroscopy, chemical and physical properties, and nucleotide sequencing. It allows for structure, substructure, and full or partial name searching on over 225,000 unique chemical substances. CIS also has an electronic mail system for communication between users. The diagram below illustrates the structure of the individual CIS databases.



The structure and Nomenclature Search System (SANSS) acts as a link between each of the CIS databases as well as providing a link via CAS Registry numbers to the bibliographic databases Lockheed (Dialog), SDC (Orbit), and NLM (MEDLARS).

COST & AVAILABILITY

CIS is available worldwide via Telenet or Tymnet 24 hours per day, 365 days a year. There is a $300 annual subscription fee, a $30-$100 per hour usage fee, and a telecommunication fee. The subscription fee and the first $100 per month usage fee is waived for academic institutions and public libraries.

INFORMATION

For information on subscriptions to CIS or information on the content of the CIS databases or help with search strategies contact:

CIS User Support Group
Computer Sciences Corporation/ATD
6565 Arlington Blvd
Falls Church, VA 22046

Telephone (800) 368-3432
(703) 237-2000
Ext 7121 or 7129

CIS COLLABORATORS

COUNTRY	ORGANIZATION
USA	National Institutes of Health Environmental Protection Agency Consumer Product Safety Commission Department of Transportation National Institute of Occupational Safety and Health Food and Drug Administration National Bureau of Standards National Technical Information Service
	Arizona State University Case Western Reserve University Chemical Abstracts Service CRC Systems, Inc. Dartmouth College Fein-Marquart Associates, Inc Infometrix, Inc Midwest Research Institute Nicolet Analytical Instruments SRI International State University of New York at Stony Brook State of Michigan—Department of Natural Resources Technology Service Corporation Thermodynamics Research Center, Texas A&M University Tracor-Jitco, Inc. University of California, San Francisco University of California, Riverside University of Rochester
Finland	University of Helsinki Technical Research Center, Espoo
Germany	Deutsche Krebsforschungszentrum Heidelberg
Holland	Netherlands Informatiecombinatie
Hungary	Hungarian Academy of Sciences
Israel	Hebrew University Jerusalem
Japan	Japan Association for International Chemical Information Kinokuniya Company Ltd Tokyo Institute of Medical Sciences Toyohashi Institute of Technology
France	University of Paris
Sweden	University of Goteborg
Switzerland	University of Bern
UK	Cambridge University Crystal Data Centre Department of Industry Fraser Williams (Scientific Systems) Ltd Mass Spectrometry Data Centre SRC Daresbury University of Manchester
USSR	USSR Academy of Sciences, Siberian Division
Yugoslavia	Boris Kidric Institute Ljubljana

NIH/EPA

CIS

Chemical Information System

STRUCTURE SEARCHING

Structure and Nomenclature Search System (SANSS) — contains information from 72 different sources on over 850,000 chemical names representing 225,000 unique substances including CAS Registry Numbers, structural diagrams, molecular formulas, systematic names, and synonyms. Has structure, substructure, and full or partial name search capabilities.

ENVIRONMENT

Oil and Hazardous Materials — Technical Assistance Data System (OHM-TADS) — provides up to 126 different fields of information for some 1,100 materials. Includes physical, chemical, biological, toxicological and commercial data on these materials, with emphasis placed on their harmful effects to water quality.

Plant and Production Data (TSCAPP) — contains information (including 127,000 production citations) for some 55,000 chemicals on the Toxic Substances Control Act Inventory concerning the manufacturer, plant location, and volume category.

Distribution Register of Organic Pollutants in Water (WDROP) — contains over 11,000 records on drinking and other types of water, data and location of water sample, compound identity, analytical method used, concentration detected, and references to published results.

TOXICOLOGY

Registry of Toxic Effects of Chemical Substances (RTECS) — contains toxicity information on over 50,000 substances including some 70,000 toxicological measurements. Provided by the National Institute of Occupational Safety and Health.

Clinical Toxicology of Commercial Products (CTCP) — contains toxicity data for approximately 20,000 common commercial products derived from some 3,000 chemicals. Symptom and treatment data are expected soon. Based upon the 5th edition publication of the same name by Gleason, Hodge, Gosselin, and Smith.

Chemical Evaluation Search & Retrieval System (CESARS) — detailed, evaluated chemical profiles taken from primary literature for over 125 compounds including toxicity data and environmental fate. Sponsored by EPA Great Lakes Program and Michigan State Department of Natural Resources.

REGULATIONS

Federal Register Notices (FRSS) — provides a cross-reference to all citations to a chemical or class of chemicals cited in the Federal Register since January 1, 1977. Contains the title, part, subpart, and a short description of the notice of the chemical of interest for over 100,000 citations.

Code of Federal Regulations: Chemical Regulations (CHEMLAW) — contains full text of all CFR Sections (annotated with chemical substance identification and descriptive abstracts) dealing with the regulation of chemical substances. A product of the Bureau of National Affairs, Inc. and Fein-Marquart Associates, Inc.

SPECTROSCOPY

Mass Spectral Search System (MSSS) — contains mass spectra of over 38,000 compounds which can be searched on the basis of peak and intensity requirements, as well as by Biemann and probability based-matched (PBM) techniques.

Carbon-13 Nuclear Magnetic Resonance Spectral Search System (CNMR) — contains over 6,500 CNMR spectra of over 5,500 compounds. Searches by chemical shift requirements permitted; analysis and display available.

Infrared Search System (IRSS) — parallels MSSS for retrieval of known spectra and analysis of unknowns. Consists of approximately 3,000 spectra taken from the EPA collection and contributions from the Boris Kidric Institute in Yugoslavia. An extensive graphics package allows for display of actual spectra on graphics compatible terminals.

BIOLOGY

Nucleotide Sequence Search System (NUCSEQ) — contains nucleotide sequence information searchable by author, journal, year, material, specific sequence, or reverse compliment.

CHEMICAL & PHYSICAL PROPERTIES

X-ray Crystallographic Search System (CRYST) — contains the bibliographic and structural files of the Crystallographic Data Centre (Cambridge, England). Over 28,000 compounds have space groups assigned which may be used as a search element. Approximately 22,500 compounds have atomic coordinates and cell parameters.

NBS Crystal Data Identification File (XTAL) — is an automated search system derived from the Crystal Data Determinative Tables published by the National Bureau of Standards. Space group, density, unit cells, and chemical types are searchable. The system currently contains over 57,000 compounds.

Thermodynamics (THERMO) — contains evaluated data on over 15,000 substances at STP including enthalpy of formation, Gibbs free energy, entropy, enthalpy, and heat capacity as well as evaluated data at 0 deg K on enthalpy of formation, physical state and crystal structure.

ANALYSIS & MODELING

Chemical Modeling Laboratory (CHEMLAB) — provides capabilities for three-dimensional conformational analysis, molecular orbital calculations, and estimation of many properties of a chemical; such as, the partition coefficient, and molecular connectivity.

Mathematical Modeling System including Cluster Analysis Laboratory (MLAB) — an interactive system for mathematical modeling as well as cluster analysis and pattern recognition studies of numeric data. Provides capabilities in the areas of curve and distribution fitting, linear and non-linear regression, statistical analysis, differential and integral calculus, and two- and three-dimensional plotting.

ARTHUR — a software package for multivariant data analysis, pattern recognition, factor analysis, and related techniques, including various mapping methods.

ELECTRONIC MAIL

MAIL — a capability of the system which allows for communication between users.

CPD

Scope:

Chemical Plant Data (CPD) is designed to provide worldwide information on chemical plants producing, or planning to produce, any of more than 100 basic chemicals. Currently, 114 chemicals, or in some cases classes of chemicals, are covered. The information available through this service is based upon material collected from a wide range of sources published in many languages, and includes technical literature, company information, annual reports, etc. In addition, companies are approached to verify the information thus provided.

Subject coverage includes:

- 114 chemical commodities
- Producing plant listings (worldwide)
- Plant capacities, start-up date
- Production/Sales/Statistical summaries
- Producer/Process/Feedstock

Access:

Currently, Chemical Plant Data is disseminated primarily in hard copy form. Online computer retrieval of this information is, however, in the planning stages. For further information contact:

The Sales Department
Chemical Data Services
Dorset House, Stamford Street
London, SE1 9LU, ENGLAND

chemical
and process
technology
encyclopedia

editor-in-chief

Douglas M. Considine

Consulting Engineer, Los Angeles, California

McGRAW-HILL BOOK COMPANY

This Encyclopedia brings together in a formal reference work the many facets of inorganic, organic, and physical chemistry and of chemical, metallurgical, and process engineering which, when viewed as an integrated body of scientific knowledge, comprise *chemical and process technology*. In a marked departure from the traditional editorial format, this book combines the detailed coverage of a handbook with the convenience and scope of an alphabetized encyclopedia.

It not only embraces the traditional spheres of interest in industrial chemistry and chemical technology as reflected by the petroleum, petrochemical, chemical, paper, textile, and other long-established process industries, but also more recent applications of an advancing and broadening chemical technology, including, as examples, the materials and processes now required by the electronics, optics, and aerospace industries. The materials sciences are given much attention.

The Encyclopedia is designed to serve as a focal information center for the traffic of knowledge from the specialist to the generalist and, in fact, from specialist to specialist. The content and style are directed to scientific, engineering, and technical business people and industrialists at the professional and management levels; regular and frequent use by educators and librarians is also a major objective.

Because of the wide range of chemical and process technology, there are few if any professionals who have a working familiarity with all the branches. When the professional seeks information on a subject with which he may not have been in touch for a long period, if at all, he seeks rapid, concise, extremely clear summaries that will provide initial orientation and lead him to further, more detailed information. Thus the reader will find strong editorial emphasis in this book on definitions of terms, clarification of nomenclature, and classification of subject matter, leading him directly and quickly to more detailed shelf literature and other information sources.

This Encyclopedia aims to provide within one volume not only the attendant convenience and economy of a single source as contrasted with multivolume works which rarely provide conclusive detail, but also a very large portion of highly select information which an interested reader may seek in his initial concern with a given topic. In many instances, because of the manner in which the information content was selected, the reader will find all the answers he is seeking within this one volume. Where further information is required, extensive reference lists, carefully culled for value, are included. Exhaustive bibliographies containing references of marginal value are not included. In most instances, references have been selected which, in themselves, contain long lists of references, so that the reader can assemble his own information bank rapidly, using this book as a starting base.

This Encyclopedia is *not* a compilation of generalities, but rather is packed with detail information, carefully selected on a priority basis by each author-specialist. Following a terse overview of a topic in most cases, the author presents details which, in his expert opinion, are the most important and timely. In outlining the content of each editorial entry, the staff and authors attempted to visualize the information needs of representative readers and, accordingly, to adjust both tone and depth of the entry. This *customized editorial approach* adjusts the technical approach and content of each topic to reflect inherent complexity and relative importance and frequency of occurrence in the information spectrum.

Classified Index

The structure of the Classified Index is shown in the table on page 1188. Each entry of this Encyclopedia is listed *once* and *only once* in the Classified Index. Cross references are used extensively throughout the book, and these references, coupled with the detailed Subject Index at the end of the volume, provide a webbing to hold all topics together even though all topics are entered into the book alphabetically. Admittedly, some of the decisions involved in placing topics under the major categories of the table were arbitrary. This situation could have been avoided only by listing some entries under several categories. Such multiple listings would have resulted in a much longer and less convenient topical classification.

CHEMICAL SUBSTANCES INFORMATION NETWORK - A SYSTEM OF SYSTEMS

The Chemical Substances Information Network (CSIN) is being developed in response to the massive data requirements of chemical regulation, toxicological research, chemical manufacture, and related activities. The system will place a valuable new tool, capable of accessing diverse types of chemical-related data, in the hands of federal and local government agencies, scientists, educators, public interest groups, and others. This will be accomplished by linking and coordinating data from several independent chemical-related information systems; which together will provide access to greater capabilities than any existing system currently supplies.

The network will meet information needs more effectively than the multiple specialized data systems. At this time, no single specialized data system satisfies all user requirements. The network will accommodate differences as they evolve, providing both the integration and diversity that are needed.

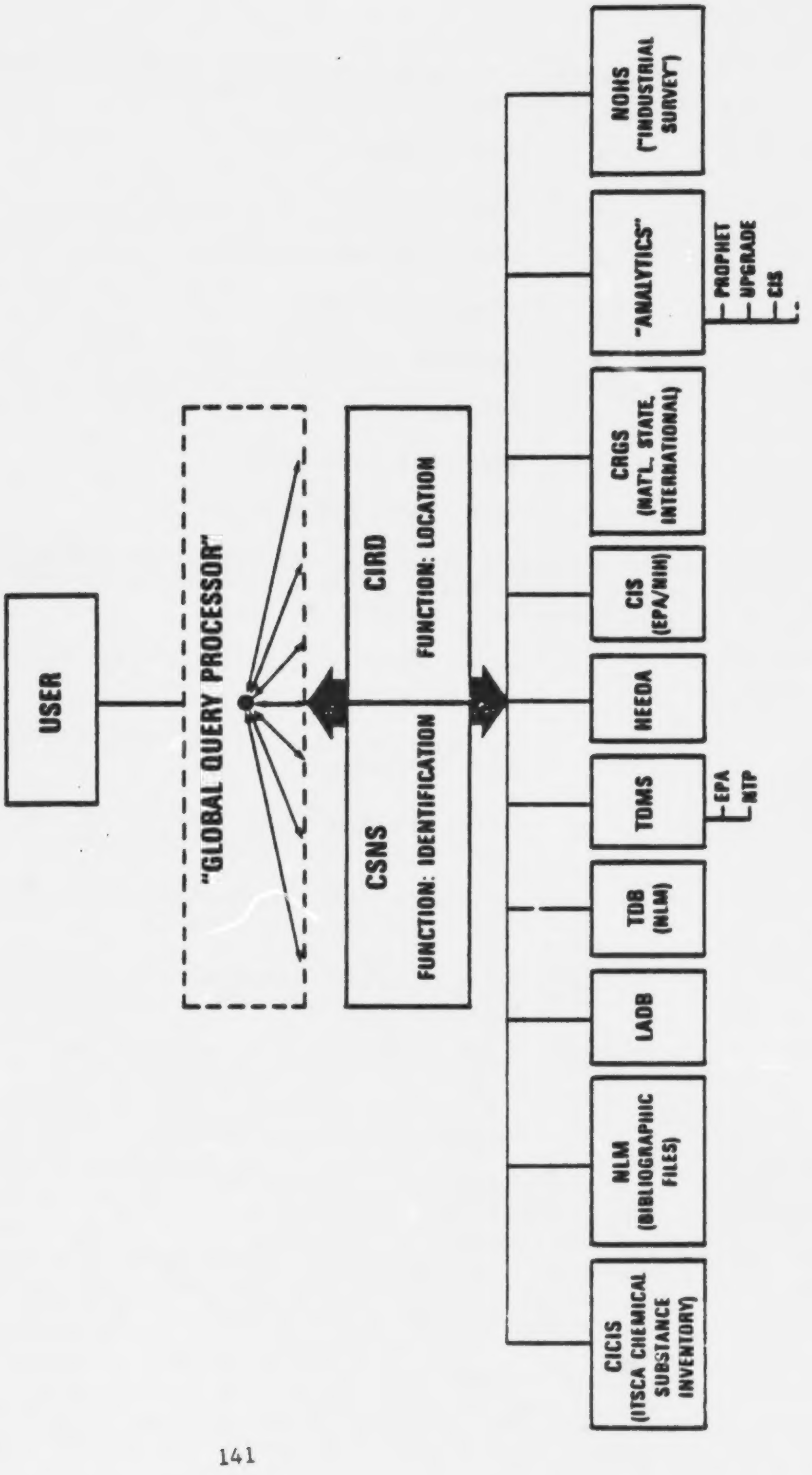
CSIN's prime goals are to simplify chemical data acquisition and to make comprehensive data available to a broad user population. Objectives related to the fulfillment of these goals include:

- integrating relevant federal and private databases in a coordinated fashion;
- providing access to a variety of databases without opening several accounts and learning various log-on and searching procedures;
- reducing the time involved in conducting a data search;
- using the results from one information resource to formulate queries to other resources; and
- providing the user with an interactive source word thesaurus capable of relating the input subject to the system vocabulary and ultimately identifying a list of CSIN resources relevant to the subject.

Figure 2 illustrates the prototype network system. Users will use the network through the public telecommunications network accessible through online terminals. Chemical identities will be determined through the Chemical Structure Nomenclature System (CSNS). For each chemical identity a unique ID number, called the Chemical Abstracts Service (CAS) Registry number will be ascertained.

Once the substance has been identified through the CSNS, the National Library of Medicine (NLM), Chemicals in Commerce Information System (CICIS), and commercially available systems will be simultaneously accessable for chemical

Figure 2


USER
"GLOBAL QUERY PROCESSOR"
CSNS
FUNCTION: IDENTIFICATION
CIRD
FUNCTION: LOCATION
CICIS (ITSCA CHEMICAL SUBSTANCE INVENTORY)
NLM (BIBLIOGRAPHIC FILES)
LADB
TDB (NLM)
TDMS
EPA
NTP
HEEDA
CIS (EPA/NIH)
CRGS (NAT'L, STATE, INTERNATIONAL)
"ANALYTICS"
PROPHET
UPGRADE
CIS
NOHS ("INDUSTRIAL SURVEY")

information. The network component systems will provide hard data , as well as bibliographic and research data, including:

- nomenclature
- properties
- production and commerce
- products and uses
- exposure
- effects
- studies and research
- regulations and controls.

CSIN will provide system users with greater capabilities than any single chemical information system that is currently available. Functional capabilities currently envisioned include:

- determining the location of data relevant to the user's request in the network;
- formulating queries to various systems in the network to retrieve relevant data;
- using the results of queries from one information resource to formulate queries to other databases;
- collecting and integrating results from several information resources and delivering them to the user;
- a global query language which allows a user to access data from various databases with a single inquiry;
- user defined query procedures; and
- direct use of certain CSIN components when such access is the best means of supplying the needed data.

CSIN will provide access to virtually every discipline relating to chemicals and their management. The current pre-prototype version of CSIN provides the user with the ability to identify chemicals on the basis of chemical name or structure; supplies online bibliographic reference to chemical, toxicological, and medical information; and provides access to the production, biological and environmental effects, and exposure of specified chemicals in commerce. Future capabilities may come from databases which contain data on federal and state regulations regarding toxic substances; protocols for ongoing toxicology experiments; baseline pathology data on control animal strains; additional bibliographic data from various private and public sources; and user prompted graphic data evaluation of monitoring and other numeric data.

Further information on the development of CSIN may be obtained from:

Dr. Sidney Siegel
Co-Network Administrator
CSIN
or
Mr. Gerry Brown
Information Scientist
Office of Pesticides and Toxic Substances
(TS-777)
U.S. Environmental Protection Agency
401 M Street, S.W.
Washington, D.C. 20460

CHEMTREC

Scope:

CHEMTREC (the Chemical Transportation Emergency Center) is an information center which provides immediate hazard warnings and guidance to those on the scene of a chemical transportation accident or emergency. Available by telephone 24 hours a day, CHEMTREC may be used by any carrier, shipper, emergency service, or other persons encountering a transport-related chemical spill, leak, fire, release, exposure, or accident. Persons who notice or suspect a leak, spill, or potential problem concerning chemicals in transport should contact CHEMTREC for assistance in preventing or remedying an emergency.

CHEMTREC will attempt to ascertain the name(s) of the product, nature of the problem, location, shipper, manufacturer, container type, rail car or truck number, carrier name, consignee, and local conditions (weather, population density) from the individual who contacts the center.

CHEMTREC maintains extensive files for the identification of trade names, chemical names, shippers, and carriers. Using these files, CHEMTREC personnel provide the caller with indications of the hazards involved and give specific instructions for handling the emergency. CHEMTREC personnel then contact the shipper and relay the particulars of the emergency, thus passing responsibility for further guidance to the shipper. In some cases, manufacturers, government agencies, police, or emergency services will be contacted directly.

The file contains 3,100 chemical dossiers searchable under 15,000 trade names. It provides 900 personal contact names for expert consultation regarding the chemical. The database is a manual card file.

Access:

Access is obtained by a telephone call to the Chemical Manufacturers Association (800-424-9300).

Cost:

Service is free.

CICIS

Scope:

The Chemicals in Commerce Information System (CICIS) is an online interactive management information system for the Office of Toxic Substances, Environmental Protection Agency (EPA). Its purpose is to store and enable utilization of information and data collected under the mandates of the Toxic Substances Control Act (TSCA). Much of CICIS' content is proprietary, but it is anticipated that a portion of the file with non-proprietary data will be made publicly available.

CICIS is being developed in modular stages. The first available and core module is the TSCA Inventory, containing chemical identification and production data submitted to EPA in 1978 by chemical manufacturers and importers as required under TSCA. Additional modules are to contain information on usage, health and safety studies, exposure, environmental effects, test results, production updates, disposal methods, and byproducts and impurities, in support of risk assessment of specific chemicals or groups of chemicals, or monitoring, environmental, planning and management, and other activities that assess the extent of the environmental program in certain localities or media. Most of these data will be submitted by chemical manufacturers as required under TSCA.

Data Files:

Among the subsystems planned for the completed CISIS are:

- Chemical Inventory System: for management of industry-reported data on chemical substances currently manufactured, processed, or imported into the U.S.; also contains data on manufacturers, processors, and importers.

- Premanufacture Submissions Module: allows users to display selected portions of data submitted in premanufacture notices.

- Chemical Information Database: includes data in the current Inventory, plus additional data from submissions.

- Organization/Site Database: will contain data specific to all industry submitters of data.

- Health and Safety Subsystem: will keep track of health and safety studies submitted for risk assessment activities. Some data from the studies may also be stored in this database.

- Test Results Subsystems: stores test result data received under TSCA and from other sources. Results will be linked to chemicals, documents and other data in the database.

Access:

The system is currently accessible by application to the U.S. EPA Office of Toxic Substances in Washington, D.C. (202-755-9336). Access to confidential information must be preceeded by EPA clearance. Ultimate access will be made available through CSIN.

ABSTRACT: The Toxic Substances Control Act (TSCA) provides EPA with authority to regulate commercial chemical substances, which pose unreasonable risk to man and the environment. CICIS supports this effort. Information maintained are chemical, plant, and production volumes. It contains chemicals manufactured or imported in the U.S., what chemicals are manufactured or imported at a given site, where plants are located, and their names. There are data for about 55,000 chemicals in CICIS.

Non-pollutant parameters include: Chemical data
Location
Manufacturer
Production levels

Ongoing study time period is 01/01/77 to 12/30/77
Termination of data collection: Occurred 12/30/78

Frequency of data collection: one time only
TSCA allows EPA to collect additional information, as required, which may serve to update the data base.

Total estimated number of observations is 48000 substances.
Estimated annual increase of observations is unknown.

Data base includes: Summary or aggregate observations

Total number of stations or sources covered is 8000 sites.
Number currently contributing data is 0.

Resource Name: OTS Dermal Absorption Database

Acronym: DERMAL

Contact: Charlie Auer
382-3476

Description: The objective of the OTS Dermal Absorption Database is to collect and organize data on the dermal absorption of chemicals. The project involves literature searching, abstract selection, article acquisition and data extraction. The data bank includes quantitative data on effects and quantitative data involving absorption, distribution and metabolism (ADME) studies. Data on toxic effects of chemicals administered via routes other than dermal (e.g., inhalation, oral and injection) were included if they appeared in articles along with dermal absorption data.

Manual or Automated: Automated

Status: Operational-enhancements ongoing

Location: DEC 20/60, SPHERE

Number of Records: Current 1,000; projected at 6-8,000

Direct or Indirect Access by User: Direct

User Interacts with Resource Through: On-line interactive; requests submitted through ISSB

Who Designed Resource: Contractor (Tracor Jitco)

Designed for Which Organizational Unit(s): CHIB, OB and TEB

Relationship of OTS to Resource: OTS developed, maintains and operates with extramural support for its own use.

Which OTS Programs are Supported by the Resource: Potential for all programs, but primarily PMN Review and Existing Chemical Review

Which Organizational Units Currently Use: HERD uses it as a source of information in evaluating a chemical's potential for, and the effects associated with, dermal absorption.

Which Organizational Unit Sets Policy for Resource: CHIB - '82, TEB - '83

DCP

Scope:

The Directory of Chemical Producers: United States of America (DCP) is an annually published book with quarterly updates. It provides ready reference to commercial chemical manufacturers and products produced in the U.S.A. Commercial chemicals are defined as those produced in excess of 1,000 pounds or $1,000 value per year. Indexes of products, companies, and regions provide access to manufacturer names, locations, and products. Supplemental information, such as annual production volumes and company relationships, are frequently included.

Data contained in the Directory are obtained from questionnaires returned from manufacturers, technical and trade journals, other contacts with manufacturers, and research. Sixteen hundred companies, representing 4,300 plant sites producing 10,000 chemicals, are reported in the volume. Each annual issue of the book contains only one year's data. The book has been published since 1961.

Access:

The Directory of Chemical Producers: United States of America is disseminated and produced by the Chemical Information Services Department, Chemical Industries Center, SRI-International, Inc., Menlo Park, California.

Cost:

The Directory of Chemical Producers is available on a subscription basis for $450 for the first year, and $300/year for subsequent renewal subscriptions. The subscription includes the book and quarterly updates.

KIRK-OTHMER

Scope:

The Kirk-Othmer Encyclopedia of Chemical Technology is a reference text which covers virtually all major aspects of chemical technology and related topics: industrial products, natural resources, manufacturing processes, and chemical uses. The third edition will include topics such as energy, health, safety, toxicology, new materials, polymer and plastics technology, inorganic and solid-state chemistry, composite materials, fermentation and enzymes, coatings, pharmaceuticals, and surfactant technology.

Second edition volumes were sequentially published from 1963-1972. In the 25 volumes of the third edition, approximately 1,000 articles written by subject experts will appear. The third edition volumes are being issued at a rate of four per year; completion of the set is expected in 1983.

Access:

The Kirk-Othmer Encyclopedia of Chemical Technology is published by Wiley-Interscience, New York (212) 867-9200.

Cost:

The third edition of the Kirk-Othmer Encyclopedia of Chemical Technology is available by subscription for $95 per volume.

Resource Name: Environmental Fate Database

Acronym: CHEMFATE

Contact: Becky Jones
382-3481

Description: CHEMFATE contains files of physical chemical properties, monitoring and field studies data, chemical identification information and bibliographic sources of fate information, including transport and degradation.

Manual or Automated: Automated

Status: Operational-enhancements ongoing

Location: Syracuse Honeywell (Designed to be incorporated into SPHERE)

Number of Records: 4,000

Direct or Indirect Access by User: Direct

User Interacts with Resource Through: On-line interactive, Requests submitted through 3rd person

Who Designed Resource: (Syracuse Research Corporation)

Designed for Which Organizational Unit(s): CHIB

Relationship of OTS to Resource: OTS developed, maintains and operates with extramural support for its own use.

Which OTS Programs are Supported by the Resource: Existing Chemical Review

Which Organizational Units Currently Use: EAB, CHIB, CFB, OPP, Enforcement, OWPE, Regional offices, state offices, universities. More OTS use is expected after it is put on SPHERE.

Which Organizational Unit Sets Policy for Resource: CHIB

Who Operates and Maintains: CHIB

Establishment Registration Support System

Acronym: ERSS
Media sampled to generate data: pesticide production data
Type of data collection/monitoring: production information for pesticide products.
Data base status: Operational/ongoing

ABSTRACT: A centralized data base is used to support inspection planning and case preparation for pesticide enforcers by maintaining a nationwide file identifying all pesticide producing establishments and their types and amounts of annual production. Data covers pesticide products as defined by the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), identified by product registration numbers. No chemical ingredient data is included.

Non-pollutant parameters include: Compliance data
Industry
Location
Production levels

Ongoing study time period is 01/01/75 to 09/30/80 (present)
Termination of data collection: Not anticipated

Frequency of data collection: annually

Total estimated number of observations is 120000.
Estimated annual increase of observations is 20000.

Data base includes: production volumes reported by producing establishments.

Total number of stations or sources covered is 8000.
Number currently contributing data is 8000.
Number of facilities covered is 8000.

Geographic coverage of data base: International, include foreign product imports to U.S.
Location identifiers of station/source for each record are: State
County
City
Street address
EPA Establishment Number
Facility identifiers include: Plant facility name
Plant location
Parent corporation name
Parent corporation location
Street address
EPA Establishment Number
Pollutant identification data have: pesticide registration number codes

HANDBOOK OF ENVIRONMENTAL DATA ON ORGANIC CHEMICALS

Karel Verschueren

Environmental Advisor
Louvain University
The Netherlands

VNR VAN NOSTRAND REINHOLD COMPANY
NEW YORK CINCINNATI ATLANTA DALLAS SAN FRANCISCO
LONDON TORONTO MELBOURNE

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INDUSTRIAL CHEMICALS

Third Edition

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ISHOW USERS MANUAL

INFORMATION SYSTEM FOR HAZARDOUS ORGANICS IN WATER

NOVEMBER 1981

BY

DR. VINCENT MAGNUSON
and
DR. DONALD HARRISS

DEPARTMENT OF CHEMISTRY
University of Minnesota, Duluth
Duluth, Minnesota 55812

ISHOW

ISHOW (Information System for Hazardous Organics in Water) is an interactive, computerized information storage and retrieval system for physical and chemical properties of organic compounds and associated aquatic toxicity data. Also featured is the ability to search and display information on the manufacturers and/or importers of these compounds.

ISHOW was developed in coordination with the Environmental Protection Agency's Region V Great Lakes Program Office and the International Joint Commission for the purposes of: (1) establishing an interactive computerized catalog of chemical, physical, and aquatic toxicity data on organic chemicals in the Great Lakes watershed, (2) providing a means to systematically determine which data elements are either unavailable or unreliable, (3) providing a readily accessible data base for structure-activity correlation studies, and (4) providing a readily accessible data base and information management system which relates physical, chemical, and aquatic toxicity data on chemicals to data on manufacturers of these chemicals.

The data base for this version of ISHOW contains 14,600 compounds. The bulk of these compounds are from the EPA Office of Toxic Substances 1977 Chemicals in Commerce Information System (CICIS) inventory. The emphasis of this project is on chemicals imported or manufactured in the Great Lakes watershed. Accordingly, only compounds used or manufactured in Minnesota, Michigan, Wisconsin, Illinois, Indiana, Ohio, Pennsylvania, and New York were selected from the CICIS inventory. Of the 14600 total compounds in the data base, 12772 fall in this category. The other 1828 compounds are of interest in structure activity studies.

Multimedia Assessment of the Inorganic Chemicals Industry

Acronym: None
Media sampled to generate data: Effluents manufacturing processes and waste treatment
Emissions manufacturing processes and waste treatment
Solid waste
Type of data collection/monitoring: Point source data collection inorganic chemical manufacturing processes
Data base status: Update terminated

ABSTRACT: Information on high volume, industrial inorganic chemicals which are compounds of aluminum, boron, chromium, fluorine, iron, manganese, nickel, phosphorus, seawater, silicon, methane, alkalie, sodium, sesquicarbonate, sulfur, titanium, barium, calcium, copper, lead, strontium, potassium, lithium, magnesium, arsenic, antimony, cadmium, cobalt, mercury, vanadium, and four industrial gases. Process description, energy requirements, raw waste description, pollution technology, and emissions after controls are also included. Occupational and health effects and research and development needs in pollution control are presented for each group of chemicals.

Non-pollutant parameters include:
- Chemical data
- Compliance data
- Concentration measures
- Cost/economic data
- Discharge points
- Disposal
- Exposure data
- Flow rates
- Geographic subdivision
- Health effects
- Industry
- Location
- Manufacturer
- Political subdivisions
- Production levels
- Treatment devices
- Use
- Volume/mass measures
- Process description
- Control technology
- Residual emissions after treatment
- disposal practices

Ongoing study time period is 01/01/75 to 08/30/80
Termination of data collection: Occurred 08/30/80

Frequency of data collection: 5 year period for data collection and update

NFPA

Scope:

"A Table of Common Hazardous Chemicals," compiled by the American Chemical Society and the National Fire Prevention Association (NFPA) Committee on Hazardous Chemicals and Explosives, presents the most authoritative data available concerning hazardous substances. Substances are listed in order to make available information about hazardous properties and fire fighting phases to improve fire protection and prevention. If a chemical is omitted from the publication, it does not mean it is not hazardous. A chemical must meet one or more of the following criteria in order to be included:

- A health hazard of 2 or higher (based on scale of 1-4; 4 the most hazardous)
- A reactivity rating of 1 or higher (based on scale of 1-4; 4 the most hazardous)
- Unusual storage or fire fighting problems
- Hazardous when contaminated with other chemicals

In this publication, the following specific types of information are provided for each chemical:

- Description
- Fire and explosion hazards
- Life hazard
- Fire fighting phases
- Usual shipping containers
- Storage
- Remarks

Access:

The manual may be purchased from NFPA, Boston, Massachusetts.

NSF-HCL

Scope:

The National Science Foundation Hazardous Chemicals List (NSF-HCL) lists organic compounds which may be of special interest with respect to possible environmental and/or health effects. The primary purpose of this list is to place in the hands of NSF and other interested organizations a list of compounds which could help guide future environmental and health research.

Access:

For a more detailed description of this project, see "Final Report of NSF Workshop Panel to Select Organic Compounds Hazardous to the Environment," October 1975. Two appendices in that report are of particular interest: Appendix IV A, where the original chemicals are ranked by release rate, and Appendix V, where the final list of 80 chemicals is ranked by order of interest.

An additional four volumes of information on this project are available through the National Technical Information Service (Research Program on Hazard Priority Ranking of Manufactured Chemicals, Phase II Final Report, SRI, ECU 3386).

OCCUPATIONAL HEALTH SERVICES, INC.

OHS

COMPUTERIZED ENVIRONMENTAL/OCCUPATIONAL HEALTH INFORMATION SYSTEMS.

NOW OVER 1000

HAZARDLINE™

A unique, online, easy-to-access databank providing instant information on over 500 hazardous workplace substances as defined by OSHA.

HAZARDLINE— Total, instant information for optimal occupational health.

OSHA standards, constantly changing... NIOSH criteria documents, growing in number... already almost 550 workplace substances designated as hazardous... 72 new chemicals introduced to industry daily... worker awareness to occupational health dramatically increasing... employer/employee occupational health related suits estimated at $125 billion and climbing... parent company suits... product liability suits... high punitive, cumulative, actual and compensatory damages being awarded in worker compensation cases.

The trend is clear... the regulatory environment in the U.S. is definitely in a state of flux. And in this constantly changing environment, how can anyone be expected to know all of the vital information required for optimal, defensible occupational health care? Yet occupational health professionals and their employers are charged with that awesome responsibility. Failure to know compromises the health and safety of human lives and can also result in serious liability for the organization.

What can you do? You can spend hours on research and still not find the answers you need. Or, if you're lucky enough to find them at all, you may not find them in time. HAZARDLINE is the electronic solution to this mind-boggling problem. It is an extraordinary, multi-faceted line of defense for the occupational health professional.

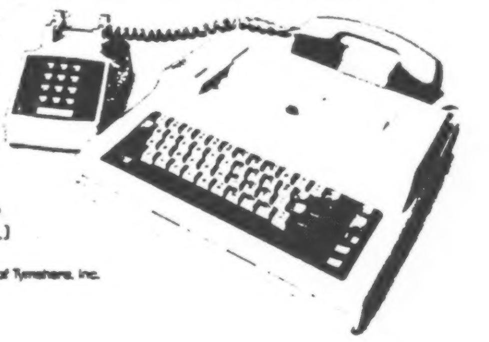
There is no other single source for so much vital occupational health information.

HAZARDLINE is a unique, online databank with an extraordinary amount of information on over 500 hazardous workplace substances. Many books, articles, and court decisions are scanned regularly by our staff of occupational health experts to keep current on all vital requirements and recommendations. New information is added to the databank continually. The service even provides clarification of vague wording that appears in some regulatory standards. All the OSHA regulations, the NIOSH criteria documents, any pertinent data from regulatory bodies... it's all in HAZARDLINE and it's up-to-date.

And HAZARDLINE goes even further. The OSHA mandate has been to protect the worker, and all regulations relate to that issue. HAZARDLINE not only includes all information necessary for protection of the worker, but has recommendations regarding action required to protect *the employer* as well. Comprehensive is an understatement.

HAZARDLINE

- Full requirements and recommendations on over 500 hazardous substances, not a bibliographic or abstract service.
- Easy, fast, convenient, cost-effective.
- NO computer required... only a standard terminal and telephone.
- NO technical background necessary.
- NO complicated training... a simple-to-understand user's manual takes the place of a lengthy training course.
- Communications access via TYMNET®* and STSC networks.
- Round-the-clock access.
- One-time, low connect fee plus constant access charge regardless of time of day.
- Terminal requirements: any standard terminal (print or video display) with the ASCII interchange may be used at operation speeds from 30 to 120 characters per second. (OHS will help you in the selection of equipment, if desired.)



*TYMNET is a registered trademark of Tymshare, Inc.

ALL-ENCOMPASSING, EASY-TO-ACCESS DATA.

The components of HAZARDLINE have been designed to provide a complete picture of hazardous workplace substances. ...and the 27 categories can be accessed with simple 4-letter commands:

CHEMICAL NAME—the name principally recognized by OSHA and NIOSH.

CHEMICAL FORMULA—in its simplest possible molecular form.

SYNONYMS—demonstrating HAZARDLINE'S ability to allow you to research a substance even if you do not know its "proper name." In other words, referring to DICHLOROMONOFLUOROMETHANE as REFRIGERANT 21, FREON 21, or HALON 112, will still get you the information you need.

CHEMICAL ABSTRACT SERVICE NUMBER—because a chemical may have several names but only one CASN, information which can prove very useful for identification purposes.

RETC—Registry of Toxic Effects I.D. Number, because knowing the RETC Number allows you access to the RETC book if you wish to supplement the HAZARDLINE data.

PHYSICAL DESCRIPTION—a complete description of the substance in question plus an additional vital feature: if the substance is suspected of being a carcinogen, teratogen, or mutagen, HAZARDLINE indicates its suspect nature using as its source the Registry of Toxic Effects and the OSHA/NIOSH Suspect List.

CHEMICAL AND PHYSICAL PROPERTIES—including molecular weight, boiling point, water solubility, flash point, vapor pressure, melting point, upper and lower explosive limits and mean explosive level, when known.

INCOMPATIBILITIES—there are 117 substances in the file which are known to be incompatible with others. This is information that OSHA does not provide.

PERSONAL PROTECTIVE CLOTHING—the standards here are often vague; but HAZARDLINE draws upon court-related data, as well as the standards, to clearly state recommendations in a way that will be useful to you.

GOGGLES—eye protection, including information that will protect both the worker and his employer.

WASH—practical recommendations on what-to-do-when if a chemical has been spilled on the body.

CHANGE—when to change workplace clothing if there is any possibility of contamination, information given to you even if clothing change is not required by OSHA.

REMOVAL—frequency and immediacy of clothing removal in case of accidental contamination, recommendations for dry sweep or dry mop when a suspected carcinogen is involved.

PROVISIONS—specific emergency provisions that the employer should provide. The OSHA standard is given, but if one does not exist, HAZARDLINE will recommend and advise steps.

RESPIRATOR—allowable use, including escape respirator requirements, firefighting respirator requirements, and class/type of respirators required at various levels of substance concentration.

ROUTE—information concerning the hazardous substance's entry into the body: inhalation, skin absorption, ingestion, skin or eye contact, radiation.

PERMISSIBLE EXPOSURE LEVEL—as allowed by OSHA standards. Also listed are NIOSH, ACGIH, ANSI and other recommendations when available, since courts have held companies responsible for the known body of literature even if there are no OSHA standards written.

IMMEDIATELY DANGEROUS TO LIFE OR HEALTH CONCENTRATION—given in p.p.m. (parts per million) or mg/m^3 (milligrams per meter cubed), depending on how the OSHA standard reads.

SYMPTOMS—following human exposure to hazardous workplace substances; these have been consolidated into a manageable form so that the occupational health professional has hands-on information regarding what symptoms a chemical will produce and its corollary: what hazardous exposure should be suspected with a known set of symptoms. When no knowledge of human exposure exists, animal data are provided.

FIRST AID—procedures following exposure in eyes, on skin, if inhaled or swallowed.

ORGANS—attacked by the substance.

STATUS—of regulatory enforcement. HAZARDLINE includes ALL of the standards that cover a substance, as well as appropriate warnings that are sometimes overlooked. On your own, you might possibly think that your research is complete after finding one standard, because you do not know that others exist. HAZARDLINE helps you avoid making this mistake.

SURVEILLANCE—*all* medical exams required by OSHA plus a clarification of vague wording and a listing of specific tests when needed.

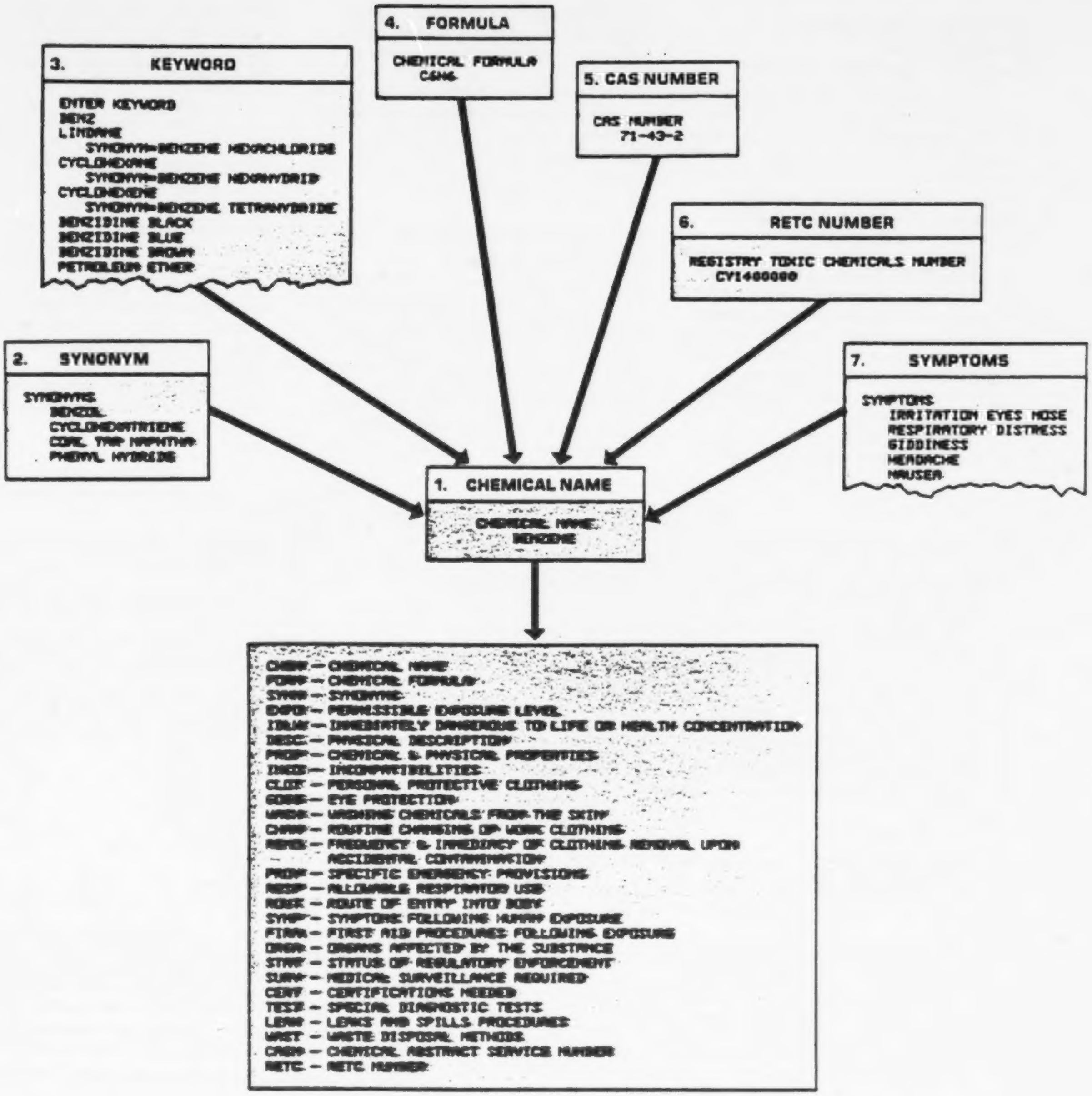
CERTIFICATIONS—a HAZARDLINE reminder of the importance of maintaining written required certifications, as well as written refusals of medical exams in employees' medical records. Although not an OSHA requirement, this section is designed to provide the employer with the most comprehensive protection.

TESTS—special diagnostic tests for difficult medical cases as required/recommended by OSHA when a worker has been exposed to a hazardous workplace substance.

LEAKS AND SPILLS—OSHA and EPA approved procedures.

WASTE—approved methods for large quantity disposal.

Twenty-seven categories of information on over 500 hazardous workplace substances—all at your fingertips.



```
ENTER KEYWORD
BENZ
LINDANE
    SYNONYM=BENZENE HEXACHLORIDE
CYCLOHEXANE
    SYNONYM=BENZENE HEXAHYDRIDE
CYCLOHEXENE
    SYNONYM=BENZENE TETRAHYDRIDE
BENZIDINE BLACK
BENZIDINE BLUE
BENZIDINE BROWN
PETROLEUM ETHER
```

```
CHEMICAL FORMULA
  C6H6
```

```
CAS NUMBER
   71-43-2
```

```
REGISTRY TOXIC CHEMICALS NUMBER
  CY1400000
```

```
SYNONYMS
   BENZOL
   CYCLOHEXATRIENE
   COAL TAR NAPHTHA
   PHENYL HYDRIDE
```

```
SYMPTOMS
   IRRITATION EYES NOSE
   RESPIRATORY DISTRESS
   GIDDINESS
   HEADACHE
   NAUSEA
```

```
CHEMICAL NAME
  BENZENE
```

```
CHEM — CHEMICAL NAME
FORM — CHEMICAL FORMULA
SYNO — SYNONYMS
EXPO — PERMISSIBLE EXPOSURE LEVEL
IDLH — IMMEDIATELY DANGEROUS TO LIFE OR HEALTH CONCENTRATION
DESC — PHYSICAL DESCRIPTION
PROP — CHEMICAL & PHYSICAL PROPERTIES
INCO — INCOMPATIBILITIES
CLOT — PERSONAL PROTECTIVE CLOTHING
GOGG — EYE PROTECTION
WASH — WASHING CHEMICALS FROM THE SKIN
CHAN — ROUTINE CHANGING OF WORK CLOTHING
REMO — FREQUENCY & IMMEDIACY OF CLOTHING REMOVAL UPON
       ACCIDENTAL CONTAMINATION
PROV — SPECIFIC EMERGENCY PROVISIONS
RESP — ALLOWABLE RESPIRATOR USE
ROUT — ROUTE OF ENTRY INTO BODY
SYMP — SYMPTOMS FOLLOWING HUMAN EXPOSURE
FIRA — FIRST AID PROCEDURES FOLLOWING EXPOSURE
ORGA — ORGANS AFFECTED BY THE SUBSTANCE
STAT — STATUS OF REGULATORY ENFORCEMENT
SURV — MEDICAL SURVEILLANCE REQUIRED
CERT — CERTIFICATIONS NEEDED
TEST — SPECIAL DIAGNOSTIC TESTS
LEAK — LEAKS AND SPILLS PROCEDURES
WAST — WASTE DISPOSAL METHODS
CASN — CHEMICAL ABSTRACT SERVICE NUMBER
RETC — RETC NUMBER
```

Many simple ways to access the HAZARDLINE databank.

One of the most valuable features of HAZARDLINE is that a particular substance can be accessed several different ways. Of course you can obtain information on a chemical if you know its name. However, that is not always the case. Therefore, HAZARDLINE is designed so that all of its data is available to you in the following ways:

1. NAME: Official chemical name.

2. SYNONYM: Access by other commonly used chemical names not officially accepted, or by trade names.

3. KEYWORD: When the full name of the chemical is not known, enter some consecutive letters from the name to get a complete listing of all chemical names, synonyms and formulas in the databank having those consecutive letters. You can then pick out of the list the chemical you wish to know more about.

4. FORMULA: Enter the chemical formula.

5. CAS#: Enter the Chemical Abstract Service Number.

6. RTEC#: Enter the Registry of Toxic Effects Number.

7. SYMPTOMS: You can identify a chemical even if you don't know its name, but do know some of its symptoms of exposure.

Fast, easy data access— no computer or computer knowledge required.

In addition to its comprehensive yet easy-to-use design, it is speed of data access that keeps HAZARDLINE ahead of all other information services providing this information. And HAZARDLINE is unique... no other electronic system provides all these vital, ever-changing requirements and recommendations.

You don't need a computer to access HAZARDLINE—the computer is at our end, in Rockville, Maryland, along with the experts to operate it. All you need is a telephone, a modem (coupler), and any standard terminal. (If you don't have the proper equipment, we will be happy to assist you in selecting one for purchase or low-cost leasing.)

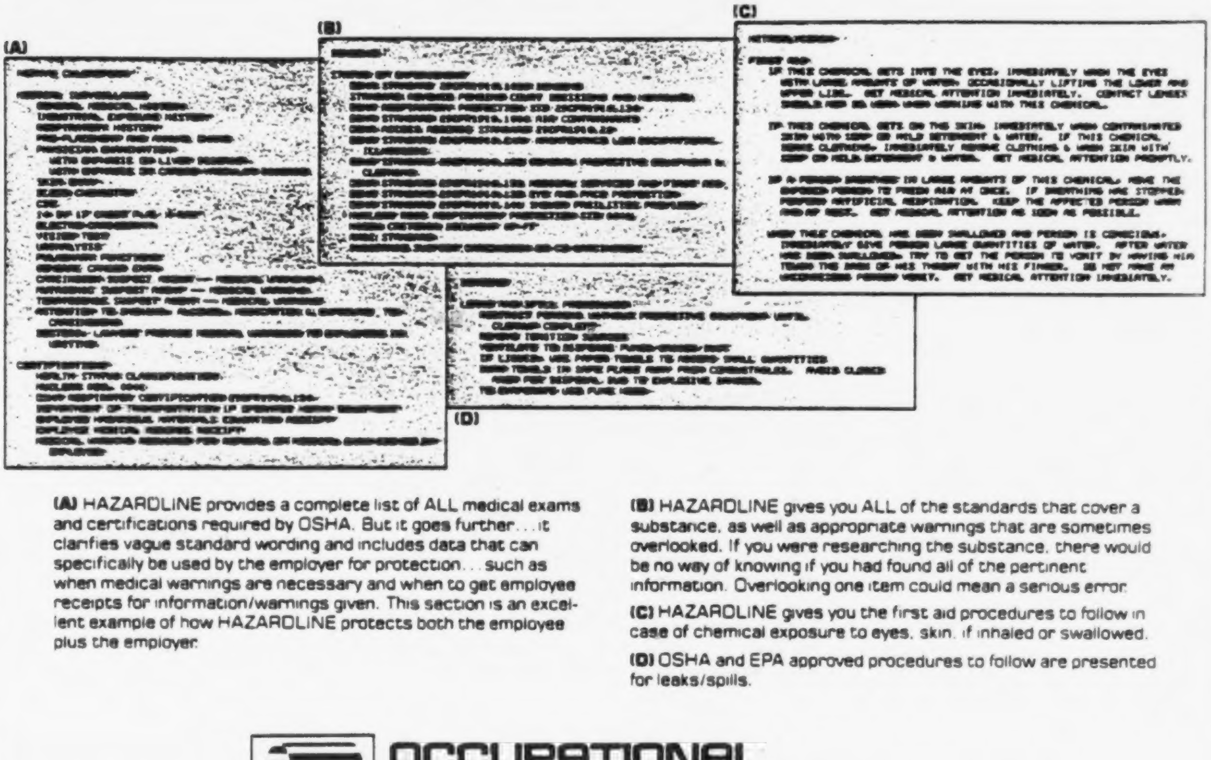
You don't need to learn a special computer language either, because HAZARDLINE is accessed by simple English commands with prompting to aid your moving from one section to another.

To access HAZARDLINE, dial a local area code telephone number, couple the telephone to the terminal, type in your identification code and the service code, and the system is ready for your request. It's that fast and that simple.

OCCUPATIONAL HEALTH SERVICES—because what you don't know can hurt you.

Awareness of workplace-related illness and disease by the public, legal community, unions, and the courts is continually growing. Occupational health professionals and their companies are being held responsible. The OSHA mandate has been to protect the worker. Occupational Health Services, with its computerized information systems, has made a commitment to aid both the worker *and* the employer, as well as the occupational health professional in the performance of his/her role.

HAZARDLINE is one way OHS is helping—ENVIRONMENTAL HEALTH NEWS™ is another. ENVIRONMENTAL HEALTH NEWS is an online news update service, alerting the environmental/occupational health professional to late-breaking events. OHS is also the creator of OMAR,™ Occupational Medical Automated Recordkeeping—a computerized, customized record-keeping and corporate medical planning system. These three unique systems, along with additional services to come, make OCCUPATIONAL HEALTH SERVICES the definitive professional resource for electronic occupational health information.



(A) HAZARDLINE provides a complete list of ALL medical exams and certifications required by OSHA. But it goes further... it clarifies vague standard wording and includes data that can specifically be used by the employer for protection... such as when medical warnings are necessary and when to get employee receipts for information/warnings given. This section is an excellent example of how HAZARDLINE protects both the employee plus the employer.

(B) HAZARDLINE gives you ALL of the standards that cover a substance, as well as appropriate warnings that are sometimes overlooked. If you were researching the substance, there would be no way of knowing if you had found all of the pertinent information. Overlooking one item could mean a serious error.

(C) HAZARDLINE gives you the first aid procedures to follow in case of chemical exposure to eyes, skin, if inhaled or swallowed.

(D) OSHA and EPA approved procedures to follow are presented for leaks/spills.

OHS

OCCUPATIONAL HEALTH SERVICES, INC.
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What you don't know can hurt you.

United States
Environmental Protection
Agency

Industrial Environmental Research
Laboratory
Cincinnati OH 45268

Research and Development

EPA-600/PS2-80-164 Sept. 1980

EPA

Project Summary

The Revised Organic Chemical Producers Data Base System

G. E. Wilkins, C. H. Tucker, and E. D. Gibson

This report describes the revised Organic Chemical Producers Data Base (OCPDB), an automated chemical industry information system developed in 1976 for the U.S. Environmental Protection Agency (EPA).

Improvements by Radian Corporation, Austin, Texas, have been made in two ways: (1) expansion of the data base to include more chemicals and more information about each chemical, and (2) implementation of the system through a data base management system.

The revised data base includes almost 600 chemicals and their more than 1300 producers. Chemicals are described by Chemical Abstracts Services (CAS) registry number, Wiswesser Line Notation (WLN), industrial process descriptions, chemical uses, synonyms, toxicity data, economic data, and producers. Priority pollutants identified as a result of Natural Resources Defense Council (NRDC) vs. EPA are marked and process descriptions are cross-referenced with another EPA reference source, The Industrial Process Profiles for Environmental Use (IPPEU) Chapter 6. Locations of producers are described by city, state, EPA region, and river basin. The chemicals that are produced at each location are listed, along with nameplate capacities, when available.

Retrieval is possible through use of any of a number of "key" data elements: chemical name, synonyms, OCPDB number, CAS numbers, WLN, priority pollutant markers, process ID number, IPPEU numbers, producer company name, parent company name, city, state, river basin, and EPA region.

Introduction

This report describes the revised Organic Chemical Producers Data Base (OCPDB) system. The original OCPDB was developed in 1976 for EPA's Industrial Environmental Research Laboratory (IERL) in Cincinnati under EPA Contract 68-02-1319, Task 51

The computerized data base that was established in 1976 provided easy access to data concerning organic chemicals and their production in a format that facilitated comparisons of various aspects of the industry. It served as a tool for understanding the organic chemical industry, for guiding EPA work in a knowledgeable and systematic manner, and for increasing work effort efficiency

Since 1977 Radian has updated the data in the OCPDB and increased the size and capabilities of the system. This interim report describes progress made toward this objective. The revised OCPDB was made fully operational in 1979. While this report describes the basic form and substance of the system, it is not meant to imply that the system is static. Changes, expansions, and improvements are expected, as the needs arise. The new system is expected to be even more responsive to changes in program needs and will allow more flexibility in operation.

Discussion and Procedure

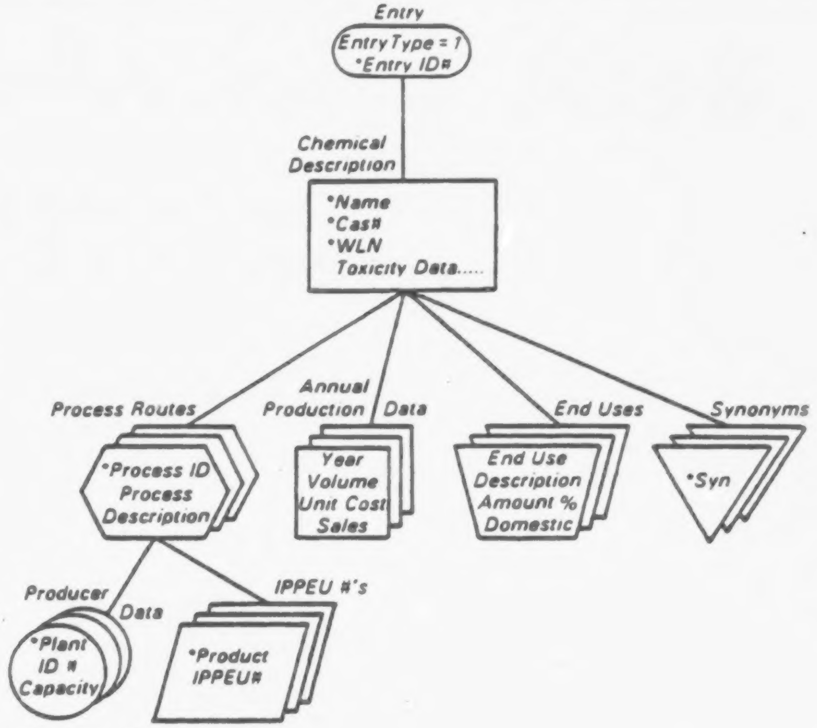
The original OCPDB consisted of a matrix of about 300 chemicals and their 610 production sites. The chemical list was begun with the one compiled by Monsanto Research Corporation under EPA Contract 68-02-1320. Several additions were made to complete the list. The basic petrochemical feedstocks were added: toluene, xylene, ethylene, propylene, C_2-C_4 hydrocarbons. Also added were chemicals that had production volumes equal to or greater than those chemicals already included (about 10 million pounds per year). Prioritized lists of toxic chemicals were examined, and chemicals not in the data base were added. The list was then compared to the list generated in the Source Assessment Program (EPA Contract 68-02-1874) to check for omissions. Production sites for the chemicals were obtained from the open literature, and this file formed the other dimension of the computerized matrix. The mechanical structures of the chemical and producer data files are shown in Figures 1 and 2.

New adjectives or descriptors were added to describe chemical entries. These include Chemical Abstracts Services (CAS) registry numbers, process routes, additional toxicity data, use descriptions, sales, and synonyms. New data files describing production sites include parent company name and river basins. The data files from the original OCPDB have been updated in cases in which new data have become available.

Table 1 lists all of the data files included in the OCPDB system. It also shows the number of unique data items, the total number of occurrences of data items within a file, and the amount of computer storage required for each file.

The revised data base has been implemented with a data base management system (DBMS), System 2000®. A DBMS was chosen to eliminate inefficiencies in the original system. System 2000® was selected because it is well-proven and widely used in commercial and governmental institutions, including EPA.

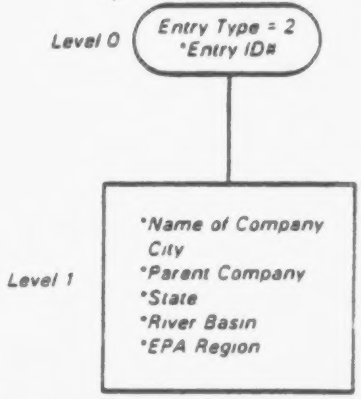
Flexibility in reporting is another major improvement in the revised system. Both interactive and batch modes of access are possible, and additional report formats may be defined at any time. Analytical report capabilities such as the "minimum sites search" have been retained and expanded through the possibility of linking the DBMS to other data handling systems.


Entry
Entry Type = 1
*Entry ID#
Chemical Description
*Name
*Cas#
*WLN
Toxicity Data.....
Process Routes
Annual Production
Data
End Uses
Synonyms
*Process ID
Process Description
Year
Volume
Unit Cost
Sales
End Use Description
Amount %
Domestic
*Syn
Producer
Data
*Plant ID #
Capacity
IPPEU #'s
*Product
IPPEU#

*Key Data Element

Figure 1. Hierarchial structure of the chemical data files of the OCPDB.

The sections of the report describe in more detail the system contents and its workings. Section 1 is an introduction to the system and its revision. Section 2 is a summary provided for those who want a quick overview of the OCPDB. A description of the data contained in the data base is presented in Section 3. The system mechanics and structure are detailed in Section 4. The capabilities of the system and an understanding of its uses can best be gained in Section 5 which contains sample reports and example access modes. Several long tables and technical sections have been appended to facilitate reading the report. Appendix A is a listing of OCPDB chemicals; Appendix B is a listing of


Level 0
Entry Type = 2
*Entry ID#
Level 1
*Name of Company
City
*Parent Company
*State
*River Basin
*EPA Region

*Key Data Elements

Figure 2. Hierarchial structure of the producer data files of the OCPDB.

System 2000® is a registered trademark of MRI Systems Corporation.

Table 1. Data Tally for the OCPDB[a]

	No. of Unique Values	*No. of Occurrences*	*Total Computer Storage Volume in No. of Bytes*
Entry Type	2	1,944	1,944
Entry ID	1,621	1,944	8,720
Chemical Related Data			
OCPDB Chemicals	597	597	14,925
CAS Numbers	518	525	5,250
New Chemical Markers	1	224	224
Priority Pollutant Markers	1	135	135
Wiswesser Line Notation	500	506	20,240
Process ID	8	1,131	2,262
Process Description	640	1,133	28,325
IPPEU Numbers	224	318	954
Uses Description	1,794	2,763	138,150
Use Volume	*b*	784	6,272
Use by % of Consumption	*b*	711	4,266
Use IPPEU Numbers	90	106	318
Synonyms	5,285	5,426	217,040
Toxicity Data			
NIOSH Registry Number	*b*	439	3,512
LD_{50} *Mode*	6	335	1,005
LD_{50} *Species*	6	335	1,005
LD_{50} *Amount*	*b*	335	2,680
LD_{50} *Units*	4	597	5,970
LC_{LO} *Mode*	3	134	402
LC_{LO} *Species*	9	134	402
LC_{LO} *Amount*	*b*	135	1,080
LC_{LO} *Units*	37	597	5,970
AQTX	*b*	170	2,496
TLV	*b*	185	1,850
TLV Units	5	597	5,970
Sax Ratings	*b*	1,470	1,470
Economic Data			
Year	15	649	1,298
Production Volume	*b*	287	2,296
Unit Cost	*b*	348	2,784
Sales	*b*	176	1,408
Producer Related Data			
Plant ID	1,246	3,703	18,515
Plant Capacity	*b*	1,190	10,710
Company Names	615	1,346	33,650
Cities	748	1,346	26,920
States	49	1,346	2,692
River Basin	321	1,082	32,460
River Basin Code	326	1,081	8,648
Parent Companies	182	340	8,500
TOTALS	14,853	36,604	632,718[c]

[a] *As of the date of this interim report.*

[b] *For non-key data files, the number of unique values is not known.*

[c] *With indices and other internal data base tables, the total number for the entire data base is approximately 2,000,000 bytes.*

Table 2. List of Key Data Elements in OCPDB

Chemical Product Entries

- *Name*
- *OCPDB Number*
- *CAS Number*
- *Wiswesser Line Notation*
- *Use Description*
- *Original OCPDB Chemical Indicator*
- *Priority Pollutant Indicator*
- *Synonym*
- *Process OCPDB Number*
- *Process IPPEU Number*

Producer Entries

- *OCPDB Number*
- *Parent Company Name*
- *Producing Company Name*
- *City*
- *State*
- *River Basin*
- *EPA Region*

OCPDB producers. River basins in which OCPDB producers are located are listed in Appendix C.

Information about accessing the system may be obtained by contacting the project officer. This publication is a summary of the complete project report, which can be purchased from the National Technical Information Service.

Three major types of directed retrieval are possible using the OCPDB: information about chemical products, information about producers, and relationships between producers and products. Retrieval is possible through use of any of a number of "key" data elements which are listed in Table 2. Using these retrieval "keys" to access the files, the sorting, filing and reporting possibilities are virtually limitless.

Pesticide Document Management System

Acronym: PDMS
Media sampled to generate data: Air
    Drinking water
    Effluents varies by producer
    Ground water
    Runoff rain water, ground water, waste water
    Sediment
    Soil
    Surface water
    Tissue animals, plants, man
Type of data collection/monitoring: scientific data varies as submitted by producers
Data base status: Operational/ongoing

ABSTRACT: The Federal Insecticide, Fungicide, and Rodenticide Act requires every pesticide manufacturer or producer to submit scientific data to EPA before a pesticide product can be manufactured, sold, or used in the United States. These data are maintained in the Pesticide Document Management System. Related information from the published literature is also included.

Non-pollutant parameters include: Biological data
    Chemical data
    Cost/economic data
    Disposal
    Exposure data
    Health effects
    Manufacturer
    Physical data
    Production levels
    Site description
    Test/analysis method
    Use

Ongoing study time period is 01/01/80 to 10/30/80 (present)
Termination of data collection: Not anticipated

Frequency of data collection: daily

Total estimated number of observations is 65000 citations.
Estimated annual increase of observations is 48000.

Data base includes: Raw data/observations
    Summary or aggregate observations
    Reference data/citations

Total number of stations or sources covered is 44941 companies.
Number currently contributing data is unknown.

Number of facilities covered is not available.

Geographic coverage of data base: National
Location identifiers of station/source for each record are: citations
Facility identifiers include: Not applicable
Pollutant identification data have: Shaughnessy Codes

Limitations: The data base is still being developed. Currently, it has limited access-batch mode by a chemical code, Shaughnessy Code; a limited number of standard retrievals and output formats; a response time of 3-4 days; and one purpose-information support to the EPA Pesticides Program. Information Requests which fall outside of these limits will require new programs and increase the response time. It contains information for 72 chemicals.

Development of regulations or standards is the primary purpose for data collection.
Compliance or enforcement is the secondary purpose for data collection.
Risk assessment is the third purpose for data collection.
Statutory authorization is P L 92-516 as amended, section 3(c)(2)(c) (FIFRA)
Form of available reports and outputs: Printouts on request
Microfilm

Form of data storage: Magnetic disc
Microfich/film
Data access: Commercial software WYLBUR
EPA hardware IBM 370/168 MIDSD system number: 7200000905

Charge for non-EPA use: no outside use/access permitted
Frequency of master file up-date: Weekly

Profile of data collection systems that measure environmental pollutants or individual exposures

Name of program or system	Agency	Purpose	Topical focus of data		Method of data collection	Population-location-time coverage	Method of data dissem-ination	Statistics generated
			Health	Environment or individual exposure				
Pesticide Use Survey	USDA	To provide data on estimated total use of specific pesticides.		Name, composition, and amount of pesticide used by farmers.	Personal interviews of a probability sample of farmers producing crops or livestock of interest.	Since 1960, 4 major crop/livestock surveys have been completed in nonmetropolitan, nonindustrial locations throughout the United States.	Tape.	Total amounts of pesticides used. Total acreage covered by a pesticide.

SYNORG

Scope:

Synthetic Organic Chemicals: United States Production and Sales (SYNORG) is a single volume annual publication of the U.S. International Trade Commission. It receives data from approximately 800 producers, and reports domestic commercial production and sales of synthetic organic chemicals and the raw materials from which they are made. Fifteen sections, organized by chemical classes, deal with: tar and tar crudes; crude products from petroleum and natural gas for chemical conversion; cyclic intermediates; dyes; organic pigments; medicinal chemicals; flavor and perfume materials; plastics and resin material; rubber-processing chemicals; elastomers; plasticizers; surface-active agents; pesticides and related products; miscellaneous end-use chemicals and chemical products; and miscellaneous cyclic and acyclic chemicals.

For each of these groups, three separate tables are provided. The first of these lists the total production and sales figures for those chemicals for which there are three or more significant producers. The second table lists the manufacturers for all chemicals (in terms of a code), and the third table defines the manufacturers code. The Commission also publishes monthly statistics on 110 of the most significant of these chemicals.

A companion publication entitled "Imports of Benzenoid Chemicals and Products, 19xx", is also available from the Commission. For this publication, the imported benzenoids are categorized in seven groups as follows: intermediates, finished products, dyes and pigments, medicinals and pharmaceuticals, flavor and perfume, and all other finished products. Various tables are provided for various groups showing imported quantities by chemical, invoice values by country of origin, etc.

Through 1975, data were reported by producers for only those items where the volume of production exceeded 1,000 pounds or where the value of sales exceeded $1,000. Beginning in 1976, these limits were raised to 5,000 pounds and $5,000 for most chemicals and 50,000 pounds and $50,000 for plastics and resin materials; the 1,000 pounds and $1,000 limits were retained for organic pigments, medicinal chemicals, flavor and perfume materials, rubber processing chemicals, and elastomers.

Access:

Available through the U.S. Government Printing Office.

AIR EMISSIONS RESOURCES

AEROS

Scope:

The Aerometric and Emissions Reporting System (AEROS) was established by the Environmental Protection Agency to serve as a management information system for EPA's air pollution research and control programs. As such, AEROS is mainly concerned with the collection, processing, and reporting of basic air pollution data. Various supplementary data files are also maintained to provide additional information valuable for the preparation and analysis of air pollution data.

The major data components of AEROS are ambient air quality data and air pollution source and emissions data. The former consists of air quality monitoring site descriptions and their data, plus pollutant and method reporting codes. Emission point sources test results are also included. The outputs are published reports and raw data output listings. Volume I of the reports is a system summary. Volume II is a system user manual. Volume III, the AEROS Summary and Retrieval Manual, is intended for those who want to obtain data from AEROS. Volume III describes AEROS reports, how they may be used, and gives instructions on how to obtain them. Volume IV is the National Air Data Branch (NADB) Internal Operations Manual, which documents, in detail, all NADB procedures related to AEROS. Certain portions of Volume IV may be of interest to persons interested in all details of AEROS operations, but is intended mainly as a guide for NADB personnel. Volume V is the AEROS Coding Manual. It contains tables of standard emission codes for use with Volume II.

Data Files:

AEROS consists of ten data storage and retrieval subsystems:

1. The National Emissions Data System (NEDS), which stores and reports source and emissions-related data for the five criteria pollutants (particulates, SOx, NOx, CO, and hydrocarbons).
2. The Storage and Retrieval of Aerometric Data (SAROAD) system, which stores and reports information relating to ambient air quality covering 65 pollutants and which includes site data.
3. The Hazardous and Trace Substance Emissions System (HATREMS), which stores and reports sources and emissions data for non-criteria pollutants.
4. The Source Test Data (SOTDAT) system, which stores and retrieves relevant technical data collected during source emission measurements (i.e., stack tests).
5. The State Implementation Plans (SIPS) regulation system, which provides retrievals of EPA-approved state air pollution control regulations.

6. The Emissions History Information System (EHIS), which provides historical trends information on nationwide emissions, and may also function as a computerized technique for examination of air pollutant-emissions scenarios.

7. The Weighted Sensitivity Analysis Program (WSAP), which operates on NEDS data to compute the variance which can be tolerated in the emission estimate for each source category in order that some overall user-specified limit shall not be exceeded.

8. The Source Inventory and Emission Factor Analysis (SIEFA) program, which complements WSAP by computing the actual (as opposed to allowable) imprecision in emission estimates for each source category in NEDS due to imprecision in emission inventory techniques and source data.

9. The Computer Assisted Area Source Emissions (CAASE) System, which calculates county ambient emissions levels.

10. The Regional Emissions Projection System (REPS), which does regional emission projections up to the year 2000.

Access:

Standard AEROS reports are published periodically and are available from the EPA Air Pollution Technical Information Center (APTIC) at Research Triangle Park, NC, or the National Technical Information Service (NTIS) in Springfield, VA. Many of the standard published reports and a number of additional standard reports are also readily available from the National Air Data Branch (NADB), Research Triangle Park, NC, or from the ten EPA Regional Offices. To meet requirements not met by standard AEROS reports, it is also often possible to restructure and report data as required in response to special requests.

Compliance Data System

Acronym: CDS
Media sampled to generate data: Air
Other compliance information
Type of data collection/monitoring: Point source data collection stationary source

Data base status: Operational/ongoing

ABSTRACT: The Compliance Data System (CDS) is a management information system used to store and retrieve enforcement related information about plants, factories, and other stationary sources of air pollution. The system was developed between 1972 and 1974 by EPA's Stationary Source Enforcement Division (SSED) for use at EPA headquarters and at EPA regional offices to meet the EPA's information needs.

Non-pollutant parameters include:
- Compliance data
- Discharge points
- Industry
- Inspection data
- Location
- Manufacturer
- Political subdivisions
- Production levels
- Site description

Ongoing study time period is 01/01/74 to 09/30/80 (present)
Termination of data collection: Not anticipated

Frequency of data collection: weekly
quarterly

Total estimated number of observations is 16000000 or more.
Estimated annual increase of observations is 2000000 or more.

Data base includes: Summary or aggregate observations
Reference data/citations

Total number of stations or sources covered is 100000 or more.
Number currently contributing data is 27000 or more.
Number of facilities covered is 50000.

Geographic coverage of data base: National
Location identifiers of station/source for each record are:
- State
- County
- City
- Town/township
- Street address
- Project identifier

Compliance or enforcement is the primary purpose for data collection.
Program evaluation is the secondary purpose for data collection.
Trend assessment is the third purpose for data collection.

Energy Data System

Acronym: EDS
Media sampled to generate data: Other No specific media: Data related to fossil fuel combustion taken from Department of Energy forms on the utility sector.
Type of data collection/monitoring: Point source data collection Utility power plants (annual and monthly reports)
Data base status: Update terminated

ABSTRACT: The data base stores fuel quality and consumption data, plant design and operation data, emission regulations, compliance information, future megawatt capacities, diffusion modeling results, and air quality data. Much of the data in the Energy Data System are extracted from existing automated data systems. The Energy Data System is unique, however, in that it combines these data in a single data base and thus provides a capability to relate emissions data, fuel consumption data, and air quality data.

Non-pollutant parameters include:
- Cost/economic data
- Flow rates
- Location
- Temperature
- Volume/mass measures
- utility boiler and stack parameters
- utility plant annual and monthly fossil fuel use
- individual fuel procurements
- fuel characteristics

Ongoing study time period is 01/01/69 to 12/30/78
Termination of data collection: Occurred 10/30/79

Frequency of data collection: monthly, annually and as needed before termination

Total estimated number of observations is 250000.

Data base includes:
- Raw data/observations
- Summary or aggregate observations

Total number of stations or sources covered is 1200.
Number of facilities covered is 1200.

Geographic coverage of data base: National
Location identifiers of station/source for each record are:
- State
- County
- SMSA
- City
- Town/township
- Street address

Limitations: Regulation data on State Implementation Plans is dated January 1, 1978; boiler identification codes recorded as on original Department of Energy forms, therefore inconsistencies occur. Some quality assurance aspects not applicable.

ENVIRONMENTAL ASSESSMENT DATA SYSTEMS

In the course of fulfilling its charter, EPA performs multimedia environmental assessments of stationary sources of pollution and conducts R&D programs to develop and demonstrate feasible control technology. Such programs generate voluminous data, often according to different reporting protocols and sampling and analysis practices. The Environmental Assessment Data Systems (EADS) have been developed to consolidate the results of these programs and others into one comprehensive information system. The EADS is also designed to provide uniformity in reporting protocols and to supply current information and methods for analyzing data.

The EADS is composed of four waste stream data bases and a number of reference and support data bases. The waste stream data bases include the Fine Particle Emissions Information System (FPEIS), the Gaseous Emissions Data System (GEDS), the Liquid Effluents Data System (LEDS), and the Solid Discharge Data System (SDDS). The FPEIS was the original data base in EADS, having become operational in 1977, and is now a mature system containing data from hundreds of stationary sources and serving the needs of a diverse user community. The GEDS, LEDS, and SDDS were initiated in 1978 and are now operational. The original FPEIS has concurrently been redesigned to conform to the requirements of expanded multimedia testing, although existing data in FPEIS will continue to be available to the user.

DATA BASE USES

The EADS has been built upon and designed around the needs of the user community. In 1977, a feasibility study indicated a significant need and desire on the part of the user community, through a questionnaire survey, to have available a central repository for environmental assessment (EA) data. In addition, at the outset of the development of the EADS, the user community was once again approached, and needs, comments, and suggestions were solicited. The EADS was originally intended to provide support for the EA program enacted by EPA's Industrial Environmental Research Laboratory at Research Triangle Park, North Carolina. While the EA program is continually changing, the fundamental uses of the generated data remain; they are (1) to establish research, development, and demonstration priorities for waste stream control, (2) to identify waste streams and pollutants requiring further attention, (3) to identify processes for which environmental standards may be needed and the technologies available for their control, and (4) to assist with other integrated technology assessments. EADS was designed to organize and store the information and data produced from EA activities, but it has not been limited, through a rigid structure dictated by EA protocols, in its ability to accommodate data from a variety of other sources. The types of data uses that EA programs and other users may find with the EADS include the following:

- Characterize emissions data according to source category, fuels, control devices, and other qualifiers
- Summarize waste stream data by EA project
- Develop emission factors

- Characterize emissions for purposes of new and retrofit control device design and application
- Assist with regional emissions studies
- Provide background data for standards development
- Assess source types with respect to toxic and hazardous pollutants
- Perform control device and waste treatment evaluations
- Provide data for correlative studies (e.g., correlating source types with radionuclide emissions)
- Provide source emissions data for various equipment design purposes
- Provide data for private industry research projects

These are fairly specific uses to which the EADS data may be employed. You may very well be asking yourself, how can I apply the EADS data to my specific problem? How will EADS make my job easier and the solution to my problem more reliable and comprehensive?

The EADS Program Library and other data manipulation procedures provide the techniques for obtaining, organizing, and, in some cases, analyzing the data contained in the multimedia data bases. The Program Library provides a great amount of flexibility to the user and simplifies the data retrieval process. One of the most useful options available to the user is the system's ability in a retrieval operation to group data into classes according to varying criteria.

CONTACTS

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A complete set of EADS documentation, in addition to the Systems Overview Manual, includes: the Gaseous Emissions Data System User Guide, EPA 600/8-80-006, January 1980; the Liquid Effluents Data System User Guide, EPA 600/8-80-008, January 1980; the Solid Discharge Data System User Guide, EPA 600/8-80-009, January 1980; the Fine Particle Emissions Information System User Guide, EPA 600/8-80-007, January 1980; and the Terminology Reference Manual, EPA 600/8-80-011, February 1980. Documentation will be either registered or unregistered. Holders of registered documentation will receive regular updates, while those with unregistered copies will not.

REIS

REGIONAL ENVIRONMENTAL
INFORMATION SYSTEM

A Proprietary Product of
CONTROL DATA CORPORATION

The Regional Environmental Information System (REIS) is a user friendly computer system offering interactive retrieval, display and manipulation of regional data. REIS is designed to provide easy access to regional data for high level managers and analysts who have little or no computer background. The system has two components: 1) a regional database, and 2) software that provides editing, retrieval and display of the database. REIS has been designed with maximum flexibility to accept data at practically any regional level and from any source or machine origin.

REIS has been developed with the empnasis on user-accessibility. Users can operate the system in a "turnkey" manner, where the system prompts the user for all required information, or in a command-language manner, where the user enters natural language type commands at the terminal. The system offers formatted reports and ad hoc query capability.

A prototype version of REIS has been developed to demonstrate the capabilities of the system. The prototype database includes: population, land area, energy consumption, energy production, selected manufacturing activity output and related air pollutant emissions, all at the state and county levels. The data currently in the database was originally developed in the Strategic Environmental Assessment System (SEAS), a large scale energy and environmental forecasting system.

Examples of the type of data in reports produced by the REIS prototype include:

- Sulfur oxide emissions by state for selected industrial activities for recent and future years.
- Population by county and state.
- Coal-fired electricity generation for selected counties for recent and future years.

An unlimited number of ad hoc queries is available as well.

WATER DISCHARGES RESOURCES

Data Collection Portfolio for Industrial Waste Discharges

Acronym: DCP
Media sampled to generate data: Effluents manufacturing point source
Other industrial sludge
Type of data collection/monitoring: Point source data collection industrial manufacturing wastes
Data base status: Operational/ongoing

ABSTRACT: The data base contains quantitative determinations of conventional and priority pollutants present in wastes discharged to land, publicly owned treatment plants, and watercourses that originate from industrial manufacturing operations. Measure of waste volume and pollutant load per ton of finished product and applied waste disposal scheme and capability are also included in the data base.

Non-pollutant parameters include:
- Chemical data
- Compliance data
- Concentration measures
- Cost/economic data
- Discharge points
- Disposal
- Flow rates
- Industry
- Location
- Manufacturer
- Political subdivisions
- Production levels
- Sampling date
- Treatment devices
- age of manufacturing plant
- water usage
- recovery techniques
- production levels
- production capacity

Ongoing study time period is 01/01/74 to 09/30/79 (present)
Termination of data collection: Anticipated 06/30/82

Frequency of data collection: Other as needed to support development of guidelines

Total estimated number of observations is 354000.
Estimated annual increase of observations is 48000.

Data base includes: Raw data/observations

Total number of stations or sources covered is 3120.
Number currently contributing data is 1 at a time in most cases.
Number of facilities covered is 3120.

Program evaluation is the primary purpose for data collection.
Development of regulations or standards is the secondary purpose for data collection.

Effluent Guidelines GC/MS Screening Analysis Data Base

Acronym: EISLIB
Media sampled to generate data: Effluents industrial, publicly owned treatment works (POTW)
Type of data collection/monitoring: Point source data collection industrial and municipal waste treatment
Data base status: Operational/ongoing

ABSTRACT: This data base contains those compounds found by computer analysis of Gas Chromatographic/Mass Spectrometric (GC/MS) data collected in Effluent Guidelines Division's screening analysis of 21 industrial categories and publicly owned treatment works (POTWs). Each entry is a tentative identification by computer matching of mass spectra in the raw data with a reference library. Tentative identifications are listed without regard for any of the chemical lists. Any or all of the organic compounds amenable to GC/MS analysis may be present.

Non-pollutant parameters include: Chemical data
Discharge points
Industry
Sampling date
Treatment devices
analysis parameters
analytical laboratory
sampling team

Ongoing study time period is 09/01/77 to 12/30/80
Termination of data collection: Anticipated 09/30/81

Frequency of data collection: as needed

Total actual number of observations is 28000.
Estimated annual increase of observations is 20000.

Data base includes: Raw data/observations

Total number of stations or sources covered is 3000.
Number currently contributing data is 3000.
Number of facilities covered is 300.

Geographic coverage of data base: National
Facility identifiers include: Effluent Guidelines Division Industrial Category Number
Pollutant identification data have: CAS registry number codes

Limitations: Data is tentative pending confirmation by chemical analysis. Effluent Guidelines Division must approve any release of data.

Data collection and analysis procedures: Sampling plan documented
Collection method documented

Development of regulations or standards is the primary purpose for data collection.
No statutory requirement: Data collection requirement is 1976 Consent Decree
Form of available reports and outputs: Printouts on request

INDUSTRIAL FACILITIES DISCHARGE FILES**

The Industrial Facilities Discharge (IFD) File was designed and implemented under contract for the specific purpose of providing the Monitoring and Data Support Division of the Office of Water Regulation and Standards with a comprehensive data base of point source dischargers. Included within this data base are approximately 44,150 pipes of the 21 industrial categories likely to contain any of the 129 priority pollutants as defined in the National Resources Defense Council et al., (NRDC) settlement agreement. Of this number, 32,750 are pipes of direct dischargers (15.4 percent of the discharges are POTW systems) and 11,400 pipes of indirect dischargers. The direct dischargers discharge over 300 billion gallons per day of wastewater to the nation's surface waters.

There are 127 data elements within the IFD data file for which data has been collected from various sources, with the following the most important:

(1) Permit Compliance System (PCS)
(2) EPA's 1978 Needs Survey File
(3) NPDES Permit Files

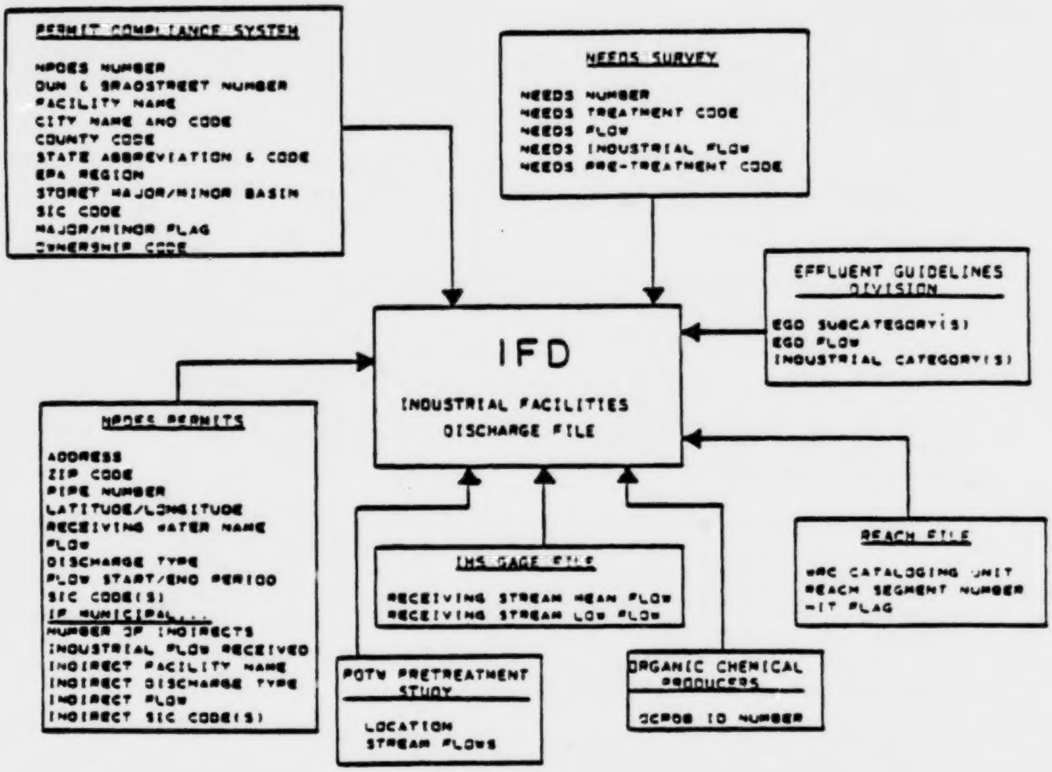
The 1978 Needs Survey file was used to collect information on all new and existing sewage treatment plants (STPs) also referred to as Publicly Owned Treatment Works (POTWs), receiving industrial flows and/or serving populations in excess of 10,000.

The industrial facilities in the IFD data file are linked to the Reach data file by a common USGS hydrologic cataloging unit number and EPA's stream segment number. The linkage of IFD with stream allows the hydrologic pin-pointing of any of all facilities along waterways. This linkage facilitates hydrological analysis of point discharger information when assessing potential pollution problems downstream of upstream of a point and between two stream locations.

The IFD data file is organized as an hierarchical information system of two levels: facility level and discharge pipe level. Facility information consists of name, address, NPDES number, city, county, total facility flow, SIC codes, and the receiving water name or the identification of POTW receiving the indirect discharge flow.

The pipe level information includes location (latitude/longitude), pipe flow, pipe SIC code, discharge type (process, cooling, etc.), receiving water, and other pipe related data.

**IFD is a component of the hydrologically-linked data files as referenced in this report. See also: GAGE, and REACH.


PERMIT COMPLIANCE SYSTEM
NPDES NUMBER
DUN & BRADSTREET NUMBER
FACILITY NAME
CITY NAME AND CODE
COUNTY CODE
STATE ABBREVIATION & CODE
EPA REGION
STORET MAJOR/MINOR BASIN
SIC CODE
MAJOR/MINOR FLAG
OWNERSHIP CODE
NEEDS SURVEY
NEEDS NUMBER
NEEDS TREATMENT CODE
NEEDS FLOW
NEEDS INDUSTRIAL FLOW
NEEDS PRE-TREATMENT CODE
EFFLUENT GUIDELINES DIVISION
EGD SUBCATEGORY(S)
EGD FLOW
INDUSTRIAL CATEGORY(S)
IFD
INDUSTRIAL FACILITIES DISCHARGE FILE
NPDES PERMITS
ADDRESS
ZIP CODE
PIPE NUMBER
LATITUDE/LONGITUDE
RECEIVING WATER NAME
FLOW
DISCHARGE TYPE
FLOW START/END PERIOD
SIC CODE(S)
IF MUNICIPAL...
NUMBER OF INDIRECTS
INDUSTRIAL FLOW RECEIVED
INDIRECT FACILITY NAME
INDIRECT DISCHARGE TYPE
INDIRECT FLOW
INDIRECT SIC CODE(S)
USGS GAGE FILE
RECEIVING STREAM MEAN FLOW
RECEIVING STREAM LOW FLOW
REACH FILE
WRC CATALOGING UNIT
REACH SEGMENT NUMBER
HIT FLAG
POTW PRETREATMENT STUDY
LOCATION
STREAM FLOWS
ORGANIC CHEMICAL PRODUCERS
OCPDB ID NUMBER

MAJOR COMPONENTS OF THE IFD FILE

National Pollutant Discharge Elimination System (NPDES) Compliance Files

Acronym: None
Media sampled to generate data: Effluents from National Pollutant Discharge
Type of data collection/monitoring: Point source data collection industrial and municipal
Data base status: Operational/ongoing

ABSTRACT: Files containing information relating to the compliance status of permit holders under the National Pollutant Discharge Elimination System (NPDES) permit program. Files are arranged in alphabetical order by State in the Water and Hazardous Materials Compliance Section. Files contain National Pollutant Discharge Elimination System (NPDES) permits, self monitoring reports, state and federal inspection reports, state and federal enforcement actions, notices of noncompliance from permittees and other correspondence relating to the status of permittee compliance.

Non-pollutant parameters include:
- Compliance data
- Discharge points
- Flow rates
- Inspection data
- Location
- Sampling date

Ongoing study time period is 09/01/74 to 08/30/80 (present)
Termination of data collection: Not anticipated

Frequency of data collection: daily
monthly discharge monitoring reports contain data typically collected daily, some may vary in frequency.

Total estimated number of observations: varies by Region.
Estimated annual increase of observations: varies by Region.

Data base includes:
- Raw data/observations
- Summary or aggregate observations

Total number of stations or sources covered: varies by Region.
Number currently contributing data: varies by Region.
Number of facilities covered: varies by Region.

Location identifiers of station/source for each record are:
- State
- City
- Town/township
- Street address
- Project Identifier NPDES number

Facility identifiers include:
- Plant facility name
- Plant location
- NPDES

Nationwide Urban Runoff Program

Acronym: NURP
Media sampled to generate data: Atmospheric deposition
Ground water
Runoff urban
Sediment
Surface water river, lake, impoundment
Other deposition on street surface
Type of data collection/monitoring: Non point source data collection
Data base status: Operational/ongoing

ABSTRACT: This data base contains data taken during storm events. The data is taken in receiving waters, control structures, wetfall/dryfall deposition stations, precipitation stations, and in storm sewers. Stormwater pollution control technologies can be evaluated from the data. For example, catchments are swept for a time period and data taken; then catchments remain unswept for a time, and data taken in order to evaluate streetsweeping. See our quarterly reports for latest results.

Non-pollutant parameters include: Biological data
Chemical data
Collection method
Concentration measures
Cost/economic data
Flow rates
Location
Physical data
Political subdivisions
Population demographics
Population density
Precipitation
Salinity
Sampling date
Site description
Temperature
Test/analysis method
Treatment devices
Volume/mass measures
hydrograph limb: base, rising, peak, falling
quality of rain

Ongoing study time period is 12/01/78 to 07/30/80 (present)
Termination of data collection: Anticipated 01/30/83

Frequency of data collection: less than hourly flow and precipitation
daily: receiving water
varies with parameter codes related to storm events

Pollutant identification data have: Storet parameter codes

Limitations: Primarily data related to urban stormwater events. Pollutant parameter codess vary by sample.

Permit Compliance System

Acronym: PCS
Media sampled to generate data: Effluents National Pollutant Discharge Elimination System (NPDES) permitted facilities
Type of data collection/monitoring: Point source data collection National Pollutants Discharge Elimination System (NPDES) permitted facilities
Data base status: Operational/ongoing
Funded for development Projected operational data: 01/00/81 - system enhancement to be completed

ABSTRACT: The Permit Compliance System is a currently operational data base, but does not yet collect effluent reported values. An enhancement to collect effluent reported values for the purpose of comparison to National Pollutant Discharge Elimination System (NPDES) limits, and therefore identify violations, is presently underway. Collection will be through data entry of Discharge Monitoring Reports (DMR) reported values. Capability will be available about January 1, 1981. Actual data entry, phased region by region, will begin at that time.

Non-pollutant parameters include:

- Collection method
- Compliance data
- Discharge points
- Flow rates
- Geographic subdivision
- Industry
- Inspection data
- Location
- Political subdivisions
- Salinity
- Sampling date
- Temperature
- Test/analysis method
- Treatment devices
- Selected National Pollutant (NPDES) Elimination System (NPDES) permit application data
- National Pollutant Discharge Elimination System (NPDES) permit effluent limits

Ongoing study time period is 01/01/75 to 08/30/80 (present)
Termination of data collection: Not anticipated

Frequency of data collection: Other ongoing: varies by National Pollutant Discharge Elimination System (NPDES) facility

Total estimated number of observations is 254,000.
Estimated annual increase of observations if 5950.

Data base includes: raw data/aggregate data: varies by permit.

Compliance of enforcement is the primary purpose for data collection.
Trend assessment if the secondary purpose for data collection.

Retrieval contact: Deborah Griffin, (202) 755-0994, USEPA, Office of Water Enforcement

Verification Data Base

Acronym: None
Media sampled to generate data: Effluents industrial
Type of data collection/monitoring: Point source data collection industrial
Data base status: Operational/ongoing

ABSTRACT: Data base contains the results of the Effluent Guideline Division GC/MS verification program.

Non-pollutant parameters include: Concentration measures
Industry
Location
Site description

Ongoing study time period is 10/01/79 to 09/30/80 (present)
Termination of data collection: Not anticipated

Frequency of data collection: one time only
varies by site-may be more frequently

Total estimated number of observations is 100000.
Estimated annual increase of observations is 30000.

Data base includes: Raw data/observations
Summary or aggregate observations
key statistics

Total number of stations or sources covered is 500.
Number currently contributing data is 10 to 15 at any one time.
Number of facilities covered is 100.

Geographic coverage of data base: National
Location identifiers of station/source for each record are: State
County
City
Street address
Project identifier
Facility identifiers include: Plant facility name
Plant location
Street address
Program identifier
Pollutant identification data are: Coded with other coding schemes

Limitations: Plant names and addresses are not identified for some organics.

Development of regulations or standards is the primary purpose for data collection.
Statutory authorization is P L 92-500 as amended (Clean Water Act-CWA)
Form of available reports and outputs: Printouts on request

WASTE DISPOSAL RESOURCES

Federal Facilities Information System

Acronym: FFIS
Media sampled to generate data: Air
Drinking water
Effluents federal facilities
Noise
Solid waste
Type of data collection/monitoring: federal facilities permit, stationary source compliance, and compliance project budgetary data.
Data base status: Operational/ongoing

ABSTRACT: The Federal Facilities Information System contains an inventory of all Federal facilities subject to environmental regulations, their compliance status, and information related to the budgeting and funding of 3,653 projects to achieve or maintain compliance (including 863 hazardous waste projects and information on radioactive and pesticide projects). The System contains and can generate the same reports as the Compliance Data System, Permit Compliance System, Hazardous Waste Site System and the Docket System.

Non-pollutant parameters include: Compliance data
Cost/economic data
Funding data
Management data is available on meeting all environmental laws.
contains all the parameters of the systems which are a part of it such as the Permit Compliance System (PCS) and Compliance Data System (CDS)

Ongoing study time period is 07/01/76 to 12/30/80 (present)
Termination of data collection: Not anticipated

Frequency of data collection: quarterly
semi annually
Quarterly data from Compliance Data System (CDS) and Permit Compliance System (PCS)
Semi-annually: Project reports

Total estimated number of observations is 350000.
Estimated annual increase of observations is 40000.

Data base includes: Raw data/observations
Summary or aggregate observations

Total number of stations or sources covered is 14000.
Number currently contributing data is 14000.
Number of facilities covered is 3000.

Geographic coverage of data base: International

Compliance or enforcement is the primary purpose for data collection.
Statutory authorization is Executive Order 12088 and OMB Circular A-106
Form of available reports and outputs: Printouts on request
Standard format reports

HAZARDOUS WASTE DATA MANAGEMENT SYSTEM

RCRA NOTIFIER DATA BASE

The primary source of information for identifying hazardous waste facilities and the particular content of the waste including the source and transport is the RCRA Notifier Data Base, a computerized data system which is individually maintained by each of the regional EPA offices. This data base was created as a result of requirements of the Resource Conservation and Recover Act of 1976, which records producers, handlers, and transporters of hazardous material, method of transportation, and ultimate disposal. This information has been stored according to hazardous waste codes assigned by EPA to specific chemical compounds, and specific or non-specific sources (e.g., industrial categories, manufacturing processes).

For further information contact: Jeff Tumerkin, USEPA/OSW
(202) 755-9145

HOW TO APPLY FOR A RCRA PERMIT

Who Must File a RCRA Permit Application

The Resource Conservation and Recovery Act of 1976 *(RCRA)* requires each person owning or operating a facility for the treatment, storage, or disposal of hazardous waste to have a permit. This includes individuals, trusts, firms, joint stock companies, corporations *(including government corporations)*, partnerships, associations, States, municipalities, commissions, interstate bodies and Federal Agencies. If you treat, store, or dispose of hazardous waste without obtaining a permit, you may be subject to civil or criminal penalty.

How to Determine If you Handle Hazardous Waste

OFF–SITE FACILITIES. Owners and operators of off–site treatment, storage, or disposal facilities are encouraged to obtain waste information from the generators they serve. If the generators will not supply this information, you are still responsible for determining if you handle a hazardous waste and should follow the procedures below for on–site facilities.

ON–SITE FACILITIES. Solid waste generators who treat, store, or dispose of their own waste on–site should follow the following procedures for determining if their waste is a hazardous waste. This determination is made as follows:

A. First, determine if the solid waste handled **is excluded** from regulation as a hazardous waste. The list of exclusions can be found in the regulation titled "Identification and Listing of Hazardous Waste", Sections 261.4 and 261.5 published in the "Federal Register," May 19, 1980. If the solid waste handled **is excluded**, a RCRA hazardous waste permit is not needed to treat, store, or dispose of these wastes.

B. If the solid waste handled **is not excluded** by Sections 261.4 or 261.5, determine if the waste is listed in Subpart D of "Identification and Listing of Hazardous Waste." Persons owning or operating facilities where listed hazardous waste is treated, stored, or disposed are subject to regulation and must file a RCRA permit application.

C. If the waste handled **is not listed** in Subpart D of "Identification and Listing of Hazardous Waste," the waste may still be hazardous because it possesses certain characteristics or contains certain contaminants. These characteristics and contaminants are contained in Subpart C of "Identification and Listing of Hazardous Waste." A determination that a waste possesses these characteristics or contaminants may be made either based on: (1) Your knowledge of the hazard characteristic of the waste in light of the materials or the processes used; or (2) The results of testing the waste according to the methods in Subpart C of "Identification and Listing of Hazardous Waste."

Certain persons who handle hazardous waste are not required to obtain a RCRA permit. They are:

Generators who accumulate their own hazardous waste on–site for less than 90 days as provided in 40 CFR 262.34;

Farmers who dispose of hazardous waste pesticide from their own use as provided in 40 CFR 262.51; and

Owners and operators of totally enclosed treatment facilities as defined in 40 CFR 260.10.

What Information Should be Filed and When

There are two parts to the RCRA permit application – Part A and Part B. Part A consists of Form 1 and Form 3 of EPA's Consolidated Permit Application. Part B requires detailed site–specific information such as geologic, hydrologic, and engineering data. 40 CFR 122.25 specifies the information that will be required from hazardous waste management facilities in Part B.

RCRA established a procedure for obtaining "interim status" which allows existing hazardous waste management facilities to continue their operations until a final hazardous waste permit is issued. In order to qualify for interim status, owners and operators of existing hazardous waste management facilities must complete and sign both Forms 1 and 3 and submit them to EPA by November 19, 1980. In order for an existing facility to receive a permit, a complete Part B must be submitted within six months after it is requested by EPA. For new facilities, both Part A and Part B must be submitted to EPA at least 180 days before physical construction is expected to commence.

Operation During Interim Status

As provided in 40 CFR 122.23(b), Part A of the permit application defines the processes to be used for treatment, storage, and disposal of hazardous wastes; the design capacity of such processes; and the specific hazardous wastes to be handled at a facility during the interim status period. Once Part A is submitted to EPA, changes in the hazardous wastes handled, changes in design of facilities, changes in processes, and changes in ownership or operational control at a facility during the interim status period may only be made in accordance with the procedures in 40 CFR 122.23(c). Changes in design capacity and changes in processes require prior EPA approval. Changes in the quantity of waste handled at a facility during interim status can be made without submitting a revised Part A provided the quantity does not exceed the design capacities of the processes specified in Part A of the permit application. Failure to furnish all information required to process a permit application is grounds for termination of interim status.

How Many Applications Should be Filed

You need submit only one RCRA permit application *(Part A and Part B)* per site or location, provided that you describe all of the activities at that site or location. If you conduct hazardous waste activity*(ies)* at more than one site or location, you must submit a separate application for each site or location.

Where to File

Permit applications should be sent to the EPA Regional office that serves the area where your hazardous waste management facility is located. If you previously received a notification packet from EPA that contains two preaddressed mailing labels and two envelopes, you should use one of the mailing labels and one of the envelopes to send your permit application to EPA. If you do not have a preaddressed mailing label, mail your permit application to the EPA Regional office that serves the area where your hazardous waste management facility is located. The mailing addresses for the EPA Regional offices are listed on the following page.

Hazardous Waste Site Tracking System

Acronym: STS
Media sampled to generate data: No specific media: Inventory of hazardous waste sites with gross amounts of chemicals found at site
Type of data collection/monitoring: No monitoring data collection
Data base status: Operational/ongoing

ABSTRACT: The data base contains an inventory of potential hazardous waste sites both active and inactive, on-site of industrial facilities and off-site. Major functions supported include: inventory and identification, assessment, site inspection, hazards, hydrological analysis, and remedial and enforcement actions necessary.

Non-pollutant parameters include:
- Compliance data
- Cost/economic data
- Funding data
- Inspection data
- Location
- Physical data
- Political subdivisions
- Population demographics
- Population density
- Site description
- Hazards
- Waste state
- Waste characteristics
- Remedial actions

Ongoing study time period is 08/01/79 to 12/30/80 (present)
Termination of data collection: Not anticipated

Frequency of data collection: As events (e.g. inspections) are done

Total estimated number of observations is 20821.
Estimated annual increase of observations is 10000.

Data base includes: Raw data/observations

Total number of stations or sources covered is 8000.

Geographic coverage of data base: National
Location identifiers of station/source for each record are:
- State
- County
- City
- Street address
- Coordinates
- Latitude/Longitude
- Coordinates

Compliance or enforcement is the primary purpose for data collection.
Remedial action is the secondary purpose for data collection.
Program evaluation is the third purpose for data collection.
No statutory requirement: Data collection requirement is to aid in EPA tracking of hazardous waste sites
Form of available reports and outputs: Printouts on request

Strategic Environmental Assessment System-Residuals Generation Module

Acronym: SEAS-RES
Media sampled to generate data: Solid waste
No specific media: data are industry emission factors for a number of pollutants
Type of data collection/monitoring: literature surveys
Data base status: Operational/ongoing

ABSTRACT: The SEAS-RESGEN Data base contains national and state average emissions factors for a number of air, water and solid waste residuals from stationary, mobile, point, and non-point sources. These data are derived from sources and are most complete for the criteria air conventional water, and pollution control related solid waste pollutants. The data base is expanding to include many more toxics and hazardous wastes. The data base is designed for use with the strategic Environmental Assessment System (SEAS).

Non-pollutant parameters include:
- Cost/economic data
- Geographic subdivision
- Industry
- Population density
- Precipitation
- Production levels

Ongoing study time period is 01/01/72 to 12/30/75
Termination of data collection: Not anticipated

Frequency of data collection: as needed

Total estimated number of observations is 100000.
Estimated annual increase of observations is Unknown.

Data base includes: Reference data/citations

Geographic coverage of data base: National
Location identifiers of station/source for each record are:
- State
- County
- SMSA
- City

Pollutant identification data have: Coded with other coding schemes

Limitations: The quality and scope of the data are variable. The user should contact the Office of Environmental Engineering and Technology before making use of the data.

Trend assessment is the primary purpose for data collection.
Anticipatory/research is the secondary purpose for data collection.
No statutory requirement: Data collection requirement is to support Agency planning efforts
Form of available reports and outputs: Printouts on request

Waste Characterization Data Base

Acronym: None
Media sampled to generate data: Solid waste
Process residuals
Type of data collection/monitoring: Point source data collection
industrial process residuals
Data base status: Operational/ongoing

ABSTRACT: Data on the amount and composition of industrial chemical process residuals. Specific compound identification and concentrations. Includes information on generator of the sample. Samples are analyzed to determine significant materials present, regardless of whether or not they are on any of the pollutant parameter lists.

Non-pollutant parameters include:

- Chemical data
- Disposal
- Industry
- Location
- Manufacturer
- Physical data
- Production levels
- Sampling date
- Test/analysis method

Ongoing study time period is 10/01/80 to 09/30/80 (present)
Termination of data collection: Not anticipated
Frequency of data collection: as needed
once or twice per generator

Total estimated number of observations is 200.
Estimated annual increase of observations is 2000.
Data base includes: Raw data/observations
Summary or aggregate observations

Total number of stations or sources covered is 25.
Number currently contributing data is 12 months.
Number of facilities covered is 25.

Geographic coverage of data base: National
Location identifiers of station/source for each record are:
State
City
Street address
Project identifier
complete facility
identification

Facility identifiers include: Plant facility name
Plant location
Street address
Dun and Bradstreet number

Development of regulations or standards is the primary purpose for data collection. Statutory authorization is P L 92-580/3007 (Resource Conservation and Recovery Act) Form of available reports and outputs: Hand searchable as needed.

AMBIENT AIR RESOURCES

Community Health Air Monitoring Program

Acronym: CHAMP
Media sampled to generate data: Air
Type of data collection/monitoring: ambient and some source
Data base status: Update terminated

ABSTRACT: The data base contains five minute values and hourly averages with peak five minute values for sixteen parameters. The data was collected to support epidemiological studies in approximately 21 cities.

Non-pollutant parameters include:
- Collection method
- Concentration measures
- Flow rates
- Location
- Sampling date
- Site description
- Temperature
- Wind direction
- Wind velocity
- dew point
- barometeric pressure

Ongoing study time period is 01/01/74 to 12/30/79
Termination of data collection: Occurred 12/30/79

Frequency of data collection: less than hourly every five minutes

Total estimated number of observations is 2500000.

Data base includes: Raw data/observations
Summary or aggregate observations

Total number of stations or sources covered is 21.
Number currently contributing data is 0.
Number of facilities covered is 21.

Geographic coverage of data base: Geographic region California, Utah, Missouri (St. Louis)
Location identifiers of station/source for each record are:
- State
- County
- City
- Street address
- Coordinates UTM

Anticipatory/research is the primary purpose for data collection.
Technology development is the secondary purpose for data collection.
No statutory requirement: Data collection requirement is to support Agency research and development program.
Form of available reports and outputs: Publications several published by Health Effects Research

Field Study Measurements

Acronym: None
Media sampled to generate data: Air
Type of data collection/monitoring: Ambient data collection
Data base status: Operational/ongoing

ABSTRACT: Measurements obtained during intensive field studies of plumes from power plants and urban area sources as well as of regional hazes are included in the data base. Aircraft and mobile and fixed surface data, together with supporting meteorological data are stored. Includes STATE and PEPE/NEROS data.

Non-pollutant parameters include: Collection method
Elevation
Location
Sampling date

Ongoing study time period is 08/01/78 to 09/30/80 (present)
Termination of data collection: Not anticipated

Frequency of data collection: Most data are 5-second averages

Total estimated number of observations is 30000000.
Estimated annual increase of observations is 1000000.

Data base includes: Raw data/observations

Total number of stations or sources covered is 31.
Number currently contributing data is 3 to be added.
Number of facilities covered is 10.

Geographic coverage of data base: Geographic region trans Applachian Region and East Coast Corridor
Location identifiers of station/source for each record are: Coordinates latitude and longitude sampling platform
Facility identifiers include: Not applicable
Pollutant identification data have: Other coding scheme

Limitations: Data are limited to periods of 3 to 5 week intensive with 50 to 100 hours sampling time per platform.

Special study is the primary purpose for data collection.
Development of regulations or standards is the secondary purpose for data collection.
No statutory requirement: Data collection requirement is for research on transformation/transport processes and effects
Form of available reports and outputs: Unpublished reports Platforms Reports
Machine-readable raw data

Inhalable Particulate Network

Acronym: IPMN
Media sampled to generate data: Air
Type of data collection/monitoring: Ambient data collection
Data base status: Operational/ongoing

ABSTRACT: The Inhalable Particulate Network contains a breakdown of particulate data by size. The data base will be used to determine the need for a new standard and the fate of the Total Suspended Particulate standards.

Non-pollutant parameters include: Collection method
Concentration measures
Flow rates
:Physical data
:Sampling date
Site description
Test/analysis method
Volume/mass measures

Ongoing study time period is 05/01/79 to 09/30/80 (present)
Termination of data collection: Not anticipated

Frequency of data collection: every six days

Total estimated number of observations is 70000.
Estimated annual increase of observations is 100000.

Data base includes: Raw data/observations

Total number of stations or sources covered is 300.
Number currently contributing data is 90.

Geographic coverage of data base: National
Location identifiers of station/source for each record are: State
County
City
Project identifier
Pollutant identification data have: Saroad parameter codes

Development of regulations or standards is the primary purpose for data collection.
Technology development is the secondary purpose for data collection.
Statutory authorization is P L 88-206 as amended, Section 110 (Clean Air Act-CAA)
Form of available reports and outputs: Printouts on request
Machine-readable raw data
On-line computer

Confidentiality: No limits on access to data
Primary physical location of data: NCC/UNIVAC
Form of data storage: Magnetic disc
Data access: Commercial software System 2000

National Air Monitoring System

Acronym: FBANK3
Media sampled to generate data: Air
Type of data collection/monitoring: Ambient data collection
Data base status: Operational/ongoing

ABSTRACT: The National Air Monitoring System stores and analyzes potential criteria pollutants at National Air Monitoring Sites. The data is used for research applications.

Non-pollutant parameters include:
- Collection method
- Concentration measures
- Flow rates
- Physical data
- Sampling date
- Site description
- Test/analysis method
- Volume/mass measures

Ongoing study time period is 01/01/74 to 09/30/80 (present)
Termination of data collection: Not anticipated

Frequency of data collection: every 12 days

Total estimated number of observations is 500000.
Estimated annual increase of observations is 50000.

Data base includes: Raw data/observations

Total number of stations or sources covered is 250.
Number currently contributing data is 250.

Geographic coverage of data base: National
Location identifiers of station/source for each record are:
- State
- County
- City

Pollutant identification data have: Saroad parameter codes

Development of regulations or standards is the primary purpose for data collection.
Trend assessment is the secondary purpose for data collection.
Statutory authorization is P L 88-206 as amended, Section 110 (Clean Air Act-CAA)
OMB form number: 158-R-0012
Form of available reports and outputs:
- Publications Air Quality Data for National Air Sampling Network (yearly)
- Printouts on request
- Machine-readable raw data
- On-line computer

Confidentiality: No limits on access to data
Primary physical location of data: NCC/UNIVAC
Form of data storage: Magnetic disc
Data access: Commercial software System 2000

National Air Surveillance Network

Acronym: NASN
Media sampled to generate data: Air
Type of data collection/monitoring: Ambient data collection
Data base status: Update terminated

ABSTRACT: Pollutant concentrations of up to 33 parameters at up to 2,500 sites, recorded bimonthly: January 1955-December 1976. Sulfate (SO4), Nitrate (NO3) and ammonium are the major available parameters--all others are reported infrequently.

Non-pollutant parameters include: Collection method
Location
Sampling date
Test/analysis method

Ongoing study time period is 01/01/55 to 12/30/76
Termination of data collection: Occurred 01/30/78

Frequency of data collection: bimonthly

Total estimated number of observations is 2000000.
Estimated annual increase of observations is 0.

Data base includes: Raw data/observations

Total number of stations or sources covered is 1350.
Number currently contributing data is 0.
Number of facilities covered is 0.

Geographic coverage of data base: National
Location identifiers of station/source for each record are: State
Project identifier
area coded
SIC code
agency
Facility identifiers include: Not applicable
Pollutant identification data have: Saroad parameter codes

Limitations: Data quality assurance procedures are unknown

Trend assessment is the primary purpose for data collection.
Anticipatory/research is the secondary purpose for data collection.

Pesticides in Ambient Air

Acronym: None
Media sampled to generate data: Air
Type of data collection/monitoring: Ambient data collection
Data base status: Operational/ongoing

ABSTRACT: Pesticides in Ambient Air is a raw data base containing about 3,000 observations. The data can only be accessed manually. Years of collection: 1970-1972, and 1975 present. The quantity of data collected each year of the 1970-1972 period is about ten times that of the 1975-1980 period.

Non-pollutant parameters include: Concentration measures
Flow rates
Location
Precipitation
Sampling date
Temperature
Wind direction
Wind velocity

Ongoing study time period is 04/01/70 to 09/30/80 (present)
Termination of data collection: Not anticipated

Frequency of data collection: monthly 90% of the data

Total estimated number of observations is 3000.
Estimated annual increase of observations is 100.

Data base includes: Raw data/observations

Total number of stations or sources covered is 80.
Number currently contributing data is 10.

Geographic coverage of data base: Geographic region selected locations in selected states
Location identifiers of station/source for each record are: State
County
City
Town/township
Street address
Pollutant identification data are: Uncoded

Limitations: Extensive annual sampling 1970-72. No data 1972-74. Fewer samples from 1975 on. Currently data base covers California, Montana, Illinois, Mississippi and Texas.

Risk assessment is the primary purpose for data collection.
Anticipatory/research is the secondary purpose for data collection.
Statutory authorization is P L 92-516 as amended by P L 94-140 and P L 95-396 section 20 (The Federal Insecticide, Fungicide, and Rodenticide Act-FIFRA)
Form of available reports and outputs: Publications Air Pollution from Pesticides and Agricultural Processes (CRC Press)

Storage and Retrieval of Aerometric Data **

Acronym: SAROAD
Media sampled to generate data: Air
Type of data collection/monitoring: Ambient data collection
Data base status: Operational/ongoing

ABSTRACT: SAROAD is a system for editing, storing, summarizing, and reporting ambient air quality data. Raw data are collected by State agencies for the criteria pollutants, reported to Regional Offices and submitted for update. The data reporting by States began in 1972-1973. The data are published in summary form, are utilized for trends analysis, and are utilized to determine whether National Ambient Air Quality Standards (NAAQS) are being met.

Non-pollutant parameters include:
- Collection method
- Concentration measures
- Elevation
- Location
- Political subdivisions
- Site description
- Temperature
- Wind direction
- Wind velocity

Ongoing study time period is 01/01/57 to 03/30/80 (present)
Termination of data collection: Not anticipated

Frequency of data collection:
- hourly
- daily
- weekly

Total estimated number of observations is 300000000.
Estimated annual increase of observations is 20000000.

Data base includes:
- Raw data/observations
- Summary or aggregate observations

Total number of stations or sources covered is 14000.
Number currently contributing data is 5000.

Geographic coverage of data base: National
Location identifiers of station/source for each record are:
- State
- County
- SMSA
- City
- Street address
- Coordinates UTM

** SAROAD is a component of AEROS which is described in the Air Emissions section of this matrix.

AMBIENT WATER RESOURCES

Basic Water Monitoring Core Stations

Acronym: None
Media sampled to generate data: Sediment
Surface water fresh
Tissue indigenous species: fish/shellfish
Type of data collection/monitoring: Ambient data collection
Data base status: Operational/ongoing

ABSTRACT: Data is collected from the national ambient water quality monitoring network of 1,000 stations, comprised primarily of a minimum "core" network of State stations selected as a subset of ongoing State programs. Stations are operated monthly, with a common list of parameter codess, and the data is used for national trend assessments.

Non-pollutant parameters include:
- Biological data
- Collection method
- Flow rates
- Geographic subdivision
- Salinity
- Sampling date
- Site description
- Temperature
- conductivity
- transparency

Ongoing study time period is 10/01/78 to 09/30/80 (present)
Termination of data collection: Not anticipated

Frequency of data collection: monthly

Total estimated number of observations is 24000.
Estimated annual increase of observations is 12000.

Data base includes: Raw data/observations

Total number of stations or sources covered is 1000.
Number currently contributing data is 1000.

Geographic coverage of data base: National
Location identifiers of station/source for each record are:
- State
- County
- City
- Town/township
- Coordinates Latitude and longitude
- Project identifier
- Agency-code
- Station-number

Pollutant identification data have: Storet parameter codes

Limitations: frequency varies by parameter codes

Name NASQAN DATA BASE SYSTEM
Acronym NASQAN
Data Base Type Spatial
System That Accesses Data Base
NATIONAL STREAM QUALITY ACCOUNTING NETWORK (NASQAN)
Division/Office
Water Resources Division
Contact Person John C. Briggs
Contact Telephone
(703) 860-6834 (FTS) 928-6834
Contact Address
U.S. Geological Survey
Water Resources Division
MS 412
Reston, VA 22092
Subject Coverage
Water-quality data from NASQAN stations
Keywords
Chemical Analyses; Rivers; Streams; Water Quality; Water Temperature
Geographical Coverage
Continental United States; Alaska; Hawaii; Guam; Puerto Rico
Spatial Data Type Point
Coordinate System Latitude/Longitude
Sources of Data in Data Base
Data are from the Water Quality File of the U.S. Geological Survey's WATSTORE system
Time Span of Data Collected
1972 to 1978

Status of Data Base Operational
Users
U.S. Geological Survey, Water Resources Division, Branch of Water Quality hydrologists
Data Availability
Available for limited access
Output Media
Magnetic tape; Batch computer printout; Publication; Punched cards
Storage Media Disc
Size of Data Base 15,000,000 bytes
Computer Residence
IBM 370/155 Reston, VA
Language SYSTEM 2000; PL/1

Abstract

The NASQAN Data Base System contains all water-quality data collected since 1972 for 445 stations constituting the National Stream Quality Accounting Network (NASQAN). Data in the system included field measurements, common constituents, and some pesticide and radiochemical constituents.

Documentation
No published documentation
Date of This Information October 1979

National Surface Water Monitoring Program

Acronym: NSWMP
Media sampled to generate data: Surface water streams
Type of data collection/monitoring: Ambient data collection
Data base status: Operational/ongoing

ABSTRACT: Contains pesticide residue and toxic substance monitoring data on 40 chemicals at approximately 150 nationwide collection stations.

Non-pollutant parameters include:
- Collection method
- Concentration measures
- Flow rates
- Geographic subdivision
- Location
- Physical data
- Political subdivisions
- Sampling date
- Site description
- Temperature
- Test/analysis method
- Use
- Volume/mass measures

Ongoing study time period is 05/01/76 to 08/30/80 (present)
Termination of data collection: Not anticipated

Frequency of data collection: quarterly

Total estimated number of observations is 90000.
Estimated annual increase of observations is 600-1000.

Data base includes: Raw data/observations

Total number of stations or sources covered is 150.
Number currently contributing data is 150.

Geographic coverage of data base: National
Location identifiers of station/source for each record are:
- State
- Coordinates Latitude and longitude

Trend assessment is the primary purpose for data collection.
Statutory authorization is P L 92-516 as amended, Section 20 (Federal Insecticide, Fungicide and Rodenticide Act-FIFRA)
Form of available reports and outputs: On-line computer

National Water Quality Surveillance System

Acronym: NWQSS
Media sampled to generate data: Surface water fresh water
Type of data collection/monitoring: Ambient data collection
Data base status: Operational/ongoing

ABSTRACT: These EPA designated ambient water quality monitoring stations augment the 1,000 "core" stations operated by the states. Stations are selected by the Regions and operated by the U.S. Geological Survey.

Non-pollutant parameters include:
- Flow rates
- Geographic subdivision
- Salinity
- Sampling date
- Site description
- Temperature

Ongoing study time period is 10/01/79 to 10/30/80 (present)
Termination of data collection: Not anticipated

Frequency of data collection: monthly

Total estimated number of observations is 9000.
Estimated annual increase of observations is 10800.

Data base includes: Raw data/observations

Total number of stations or sources covered is 53.
Number currently contributing data is 41.

Geographic coverage of data base: National
Location identifiers of station/source for each record are:
- State
- County
- City
- Town/township
- Coordinates
- Latitude/longitude
- agency code
- station number

Facility identifiers include: Not applicable
Pollutant identification data have: Storet parameter codes

Trend assessment is the primary purpose for data collection.
Statutory authorization is P L 95-217, Section 104(2)(5)
Form of available reports and outputs:
- Publications National Water Quality Inventory/Report to Congress
- Unpublished reports December 1 Report to the Administrator
- Printouts on request
- Machine-readable raw data
- On-line computer
- included in Council on Environmental Quality Report

REACH FILE

The Reach file consists of 72,050 segments which are associated with 2,111 USGS cataloging units.

The Reach file is "pivotal" for hydrologic use in that four data files are "linked" together by the common use of cataloging units, segment numbers and mileages. These four files are:

(1) Industrial Facilities Discharge (IFD)
(2) Pollution-caused Fishkill File
(3) Drinking Water Supply File
(4) Stream Gaging Inventory Data File

All stream reaches have been linked hydrologically to allow for retrieval and analysis downstream or upstream of a point to between points. The linearized segment data are used for mapping and location plotting for STORET Water Quality, IFD, GAGE, Water and Fishkill data.

For information on the REACH File Directory and associated maps, the reader is referred to Robert Horn, Monitoring Branch, Monitoring & Data Support Division.

**REACH is a component of the hydrologically-linked data files as referenced in this report. See also: IFD, GAGE.

STORET

Scope:

STORET is an acronym used to identify the computerized database system maintained by EPA for the STOrage and RETrieval of data relating to the quality of the waterways within and contiguous to the United States. Within the STORET system, some 1,800 unique water quality parameters (a parameter is essentially the objective of a measurement such as the concentration of a particular substance in a particular medium) are defined. Approximately 80% of the 40 million individual observations available within the system pertain to approximately 200 of these parameters which deal with concentrations of conventional pollutants (BOD, N, P, etc.) and metals in water. A single observation represents a measurement of a single parameter at a specific location or station at a specific point in time. These observations are taken from more than 200,000 unique collection points located on essentially all U.S. rivers, lakes, streams, and other waterways.

The STORET system is fully computerized; it permits users throughout the country to enter observations into the database as well as to retrieve information from the database through remote terminals. A comprehensive range of retrieval capabilities, both in the statistical analysis of observations, and the reporting of the results of the analyses, is provided by STORET. Some of these services are available in an online mode of operation, others in a batch mode of operation.

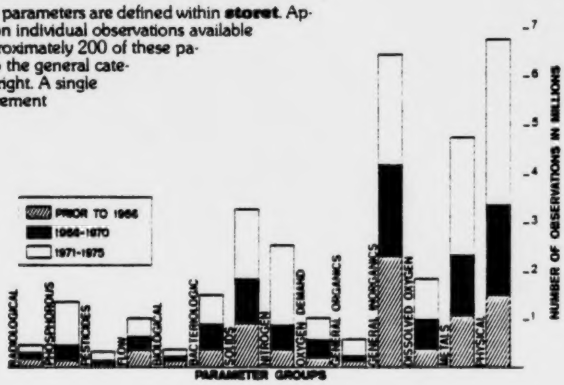
STORET can be used for the following purposes:

- To detect changes in pollutants that could change ambient criteria/standards.
- To help promote water quality programs by substantiating the effectiveness of other similar programs.
- To help justify budget requests for water quality programs.
- To help cut sampling costs by coordinating efforts with other organizations.
- To provide a repository for data collection efforts.
- To help identify where monitoring efforts are needed, thereby determining where funds need to be allocated.
- To help design overall programs based upon the successes of others.
- To help complete water quality management basin plans.
- To help prepare fact sheets required for permit processing.
- To detect changes in pollutants that could change existing permits.

storet provides water quality data

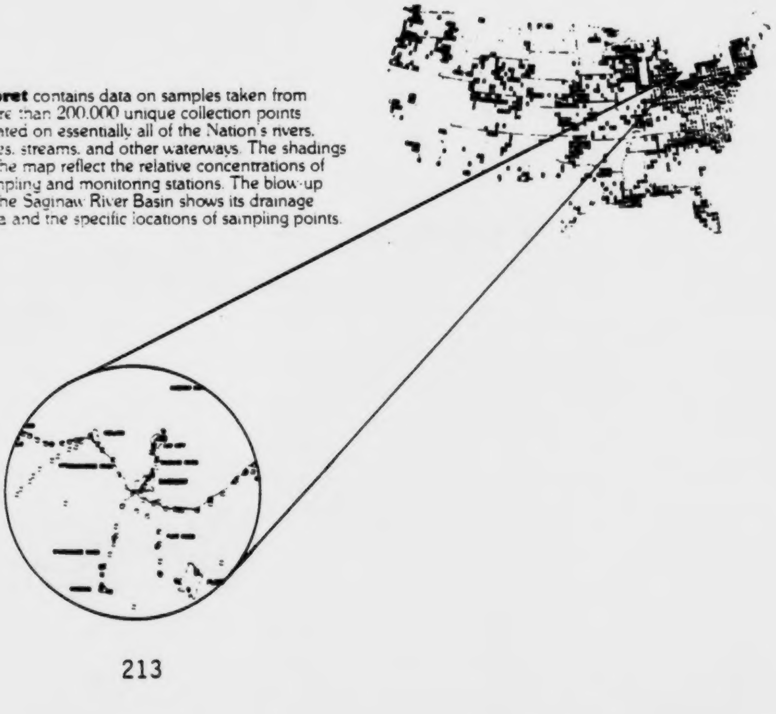
on the right parameters

Some 1800 unique water quality parameters are defined within **storet**. Approximately 80% of the 40 million individual observations available within the system pertain to approximately 200 of these parameters which are grouped into the general categories shown in the table to the right. A single observation represents a measurement of a single parameter at a specific location, or station, at a specific point in time.



at the right stations

storet contains data on samples taken from more than 200.000 unique collection points located on essentially all of the Nation's rivers. lakes. streams. and other waterways. The shadings of the map reflect the relative concentrations of sampling and monitoring stations. The blow-up of the Saginaw River Basin shows its drainage area and the specific locations of sampling points.

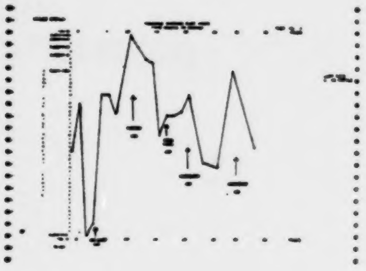


A river basin is the area drained by a single river and its tributaries. A water quality management basin plan is a management document that identifies the water quality problems of a particular basin, or portion of a basin, and sets forth an effective remedial program to alleviate those problems. Overall basin needs and priorities are assessed, actions scheduled, and the necessary coordination with concerned organizations planned.

basin planning

The needs and priorities are based largely upon water quality data and the analysis of this data. For example, fecal coliform bacteria is a common indicator of pollution problems in areas affected by major municipal/industrial activity. A plot of coliform along a stretch of a river can quickly ascertain the presence of a bacterial source and the extent of a pollution problem.

The development of an effective planning process is crucial to effective water quality management. This is particularly true for river basin planning as required under various sections of PL 92-500. River basin plans are primarily the responsibility of the states, and the law delineates the rather extensive amount of information that must be provided.



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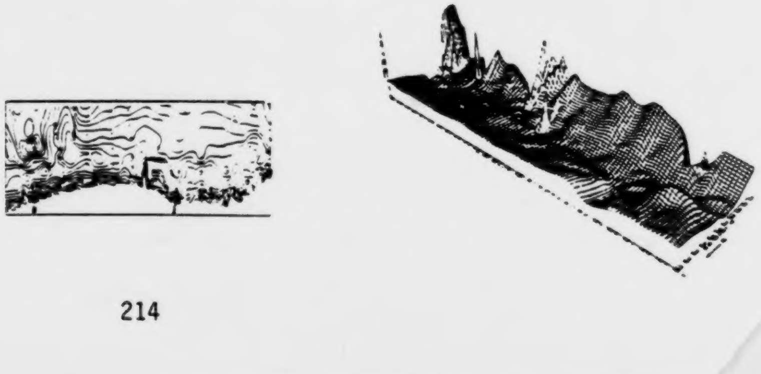
research

In order to achieve our national objective of having water that is clean enough both for recreational activity and for the protection of fish and wildlife, numerous research and development efforts have been initiated to acquire a thorough understanding of the complex and variable biological systems that characterize our waterways. Research tells us what a specific level of a specific pollutant does to humans, animals, and crops. It establishes thresholds at which we might expect adverse effects from environmental pollutants, alone or in combination. (And from these thresholds, criteria for water quality standards can be established.) It provides the basic scientific knowledge we need to safeguard the public health and to balance the benefits of a specific product against its environmental risks.

A representative effort is that of the EPA Grosse Ile Laboratory's Research Program to improve the water quality of the Great Lakes. This Lab is involved with a number of other agencies in developing the scientific information needed to assess the effectiveness of implemented programs on Great Lakes water quality, to form the basis for needed control actions, and to develop the scientific information needed to support the Canada-U.S. Agreement for the Great Lakes. Over a dozen U.S. and Canadian agencies, universities, and joint commissions are participating in this extensive program launched in 1972.

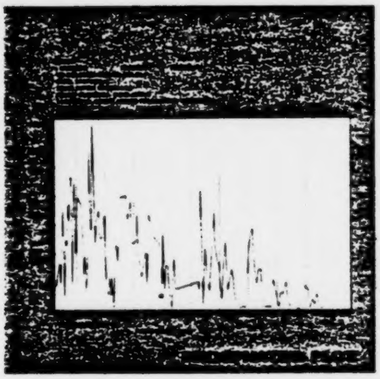
Since this is an on-going international program involving both water quality management and research, it is essential that all data gathered on the water quality of the Great Lakes be readily accessible by all investigators. Accordingly, all participants are required to enter all collected data into **storet**, thereby greatly expediting the use and analysis of the information through sharing of data. This significant, multi-organizational use of storet not only illustrates the value of **storet** in research-oriented endeavors, but also demonstrates how the use of an accepted central system can foster cooperation among a group of organizations sharing common interests.

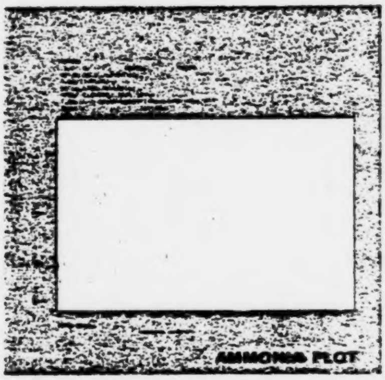


CHLOROPHYLL A IN LAKE ONTARIO
TWO PERSPECTIVE VIEWS

monitoring & surveillance

The data in **storet** originates from samples taken as part of individual monitoring programs conducted by the states and other organizations. Several objectives of these monitoring efforts are to identify and assess quantitatively the magnitude of existing and potential water pollution problems, and to detect any trends or changes over a period of time. Reports such as the trend plots shown here, which show presence of phosphates and ammonia as a function of time, vividly point out where problems do and do not exist.

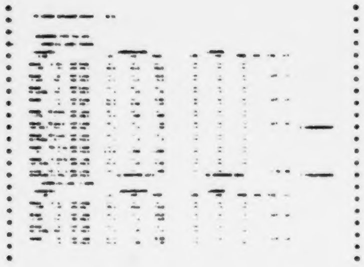




npdes permit program

Far-reaching goals were established by PL 92-500: By 1983, water clean enough for swimming, boating, and protection of fish, shellfish, and wildlife; and by 1985, no discharges whatsoever of pollutants into the Nation's waters! To achieve these ambitious but essential goals, the law established a national permit program, known as NPDES—the National Pollutant Discharge Elimination System, to control the discharge of pollutants into any waterway. This program is the mechanism for insuring that effluent limits are met, that the necessary technology is applied, and that all requirements of the 1972 law for controlling discharges and complying with water quality standards are met on schedule. Permits are to be granted to individual dischargers only after they show that their effluents will not contaminate a waterway in excess of established water quality standards, or will not lower its existing quality.

The law allows polluters time to improve facilities, but provides that corrective programs must meet the "best practicable" and "best available" standards of water pollution control technology by 1977 and 1983 respectively.



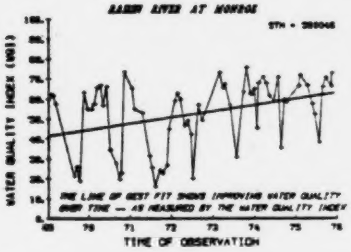
EFFLUENT VIOLATIONS REPORT

progress reporting

Under Section 305(b) of PL 92-500, states are required to submit annual reports to EPA on sources of pollution—their nature, extent, recommendations for control, and the cost of these controls. (An excerpt from the State of Michigan's 305(b) report is shown below.) As practices become more sophisticated, these reports should reflect the effects of these sources on the pollution of groundwaters, and provide an inventory of wells which can be used to determine groundwater quality within a state's jurisdiction.

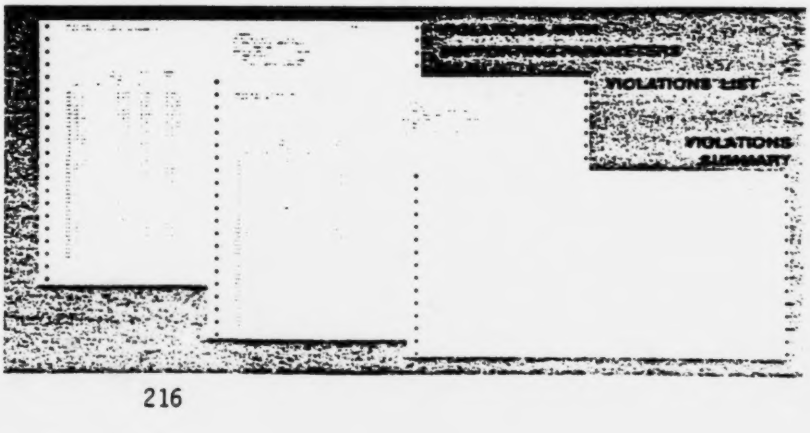
A new activated sewage treatment plant was built on Fountain Creek below Colorado Springs in late 1972. The data in **storet** collected prior and subsequent to the implementation of the new plant were compared. The number of violations for dissolved oxygen had dropped from 53% to 7%, for dissolved solids from 59% to 33%, for BOD from 85% to 73%, and for fecal coliform from 89% to 58%. Similar improvement occurred and was demonstrated when a sewage treatment plant was built in the Fargo, North Dakota area.

These examples show the applicability of using the data in **storet** to demonstrate progress either from an over-all point of view or from the viewpoint of a single effort.



standards & criteria

Associated with specific water uses are the water quality standards which must be met in order for the water to be used for its intended purposes, consistent with the 1983 goals of water quality. Once standards have been established by states in accordance with national criteria, it is necessary to monitor the effect of water pollution abatement and control activities relative to those criteria. A number of **storet** report programs can be used, such as the ones pictured below, to track the progress of water quality improvement efforts.

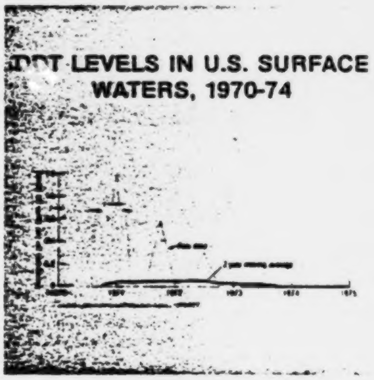

VIOLATIONS LIST
VIOLATIONS SUMMARY

Reproduced from best available copy.

toxic substances

Although many substances are potentially toxic to aquatic life and other organisms when present in sufficient concentration for a sufficient period of time, the term toxic substances generally refers to those substances which are dangerous even in very low concentration. Consequently, the 1977 and 1983 deadlines for limiting pollutant discharges do not apply in the cases of these deadly substances, such as mercury, cadmium, and toxaphene. Steps required to meet standards established for toxic substances must be taken quickly to protect the public health and welfare. To this end, EPA is empowered to restrain discharges of any pollutants which present an imminent and substantial endangerment to the health or livelihood of the public.

All toxic substances for which water quality analyses have been performed are defined within **storet**, and the system can easily accommodate the inclusion of additional substances upon their discovery. Reports such as the one shown below (from a Council on Environmental Quality report) can be readily obtained from **storet** data to demonstrate the presence or absence of toxic substances in any body of water for which data are available.



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in summary, the right answer

These pages have shown a number of uses made of **storet**, and its wealth of water quality data, by a variety of governmental agencies and other organizations. To further underscore the role that **storet** can play to help you fulfill your water quality assessment and management objectives, consider the following additional answers that **storet** can provide.

- **Help evaluate cost-effectiveness of previously implemented water quality programs**
- **Help promote water quality programs by substantiating the effectiveness of other similar programs**
- **Help justify budget requests for water quality programs**
- **Help cut sampling costs by coordinating efforts with other organizations**
- **Provide a repository for your data collection efforts**
- **Help identify where monitoring efforts are needed, thereby determining where funds need to be allocated**
- **Help design overall programs based upon the successes of others**
- **Help complete water quality management basin plans**
- **Help prepare fact sheets required by permit applications**
- **Detect changes in pollutants that could change existing permits**

How can storet help you?

STREAM GAGING INVENTORY FILE**

The GAGE data file contains information on approximately 36,514 stream gaging locations throughout the United States. Information stored includes location of gaging stations, types of data collected, frequency of data collection, media in which data are stored, identification of the collecting agency, and where available from the Basin Characteristics File, mean annual flow and 7 day/10 year low flow.

The primary sources of data for the GAGE Data File were:

(1) National Water Data Exchange (NAWDEX)
(2) Master Water Data Index (MWDI)
(3) Basin Characteristics File (BCF)
(4) STORET Flow File (USGS Daily Value Flows)

During 1979, cataloging units and reach numbers were determined and coded for the USGS gaging stations identified in the Basin Characteristic File. These stations are considered to have the longest periods of natural flow data (i.e., flow not affected by human activities) and would therefore be valuable in water quality assessment work.

The GAGE file provides a common place for gage information to assist those involved in activities such as water quality studies, waste load allocations, dilution studies, and advanced waste treatment assessments.

**GAGE is a component of the hydrologically-linked data files as referenced in this report. See also: REACH, IFD.

WATSTØRE:

A WATer Data
STOrage and
REtrieval System

The U.S. Geological Survey, through its Water Resources Division, investigates the occurrence, quantity, quality, distribution, and movement of the surface and underground waters that constitute the Nation's water resources. It is the principal Federal water-data agency and, as such, collects and disseminates about 70 percent of the water data currently being used by numerous State, local, private, and other Federal agencies to develop and manage our water resources. These hydrologic data are used not only in determining the adequacy of water supplies, but also in designing dams, bridges, and flood control projects; in allocating irrigation waters; in locating sources of pollution; in planning for energy development; and in predicting the potential effects of radioactive waste disposal on water supplies.

As part of the Geological Survey's program of releasing water data to the public, a large-scale computerized system has been developed for the storage and retrieval of water data collected through its activities.

The National WATer Data STOrage and REtrieval System (WATSTØRE) was established in November 1971 to modernize the Geological Survey's existing water-data processing procedures and techniques and to provide for more effective and efficient management of its data-releasing activities. The system is operated and maintained on the central computer facilities of the Survey at its National Center in Reston, Va. Data may be obtained from WATSTØRE through any of the Water Resources Division's 46 district offices listed at the end of this leaflet.

System Description

The Geological Survey currently (1981) collects data at approximately 16,000 stream-gaging stations, 1,000 lakes and reservoirs, 5,200 surface water quality stations, 1,020 sediment stations, 30,000 water-level observation wells, and 12,500 ground water quality wells. Each year many water-data collection sites are added and others are discontinued; thus large amounts of diversified data, both current and historical, are amassed by the Survey's data-collection activities.

The WATSTØRE system consists of several files in which data are grouped and stored by common characteristics and data-collection frequencies. The system is also designed to allow for the inclusion of additional data files as needed. Currently, files are maintained for the storage of (1) surface-water, quality-of-water, and ground-water data measured on a daily or a continuous basis, (2) annual peak values for streamflow stations, (3) chemical analyses for surface- and ground-water sites, (4) water-data parameters measured more frequently than daily, (5) geologic and inventory data for ground-water sites, and (6) summary data on water use. In addition, an index file of sites for which data are stored in the system is also maintained.

Station Header File

All sites for which data are stored in the Daily Values, Peak Flow, Water-Quality, and Unit Values Files of WATSTORE are indexed in this file. It contains information pertinent to the identification, location, and physical description of nearly 263,000 sites.

Daily Values File

All water-data parameters measured or observed either on a daily or on a continuous basis and numerically reduced to daily values are stored in this file. Instantaneous measurements at fixed-time intervals, daily mean values, and statistics such as daily maximum and minimum values also may be stored. This file currently contains more than 200 million daily values, including data on streamflow, river stages, reservoir contents, water temperatures, specific conductance, sediment concentrations, sediment discharges, and ground-water levels.

Peak Flow File

Annual maximum (peak) streamflow (discharge) and gage height (stage) values at surface-water sites constitute this file, which currently contains more than 400,000 peak observations.

Water-Quality File

Results of more than 1.8 million analyses of water samples that describe the chemical, physical, biological, and radiochemical characteristics of both surface and ground waters are contained in this file. These analyses contain data for 185 different constituents.

Unit Values File

Water parameters measured on a schedule more frequent than daily are stored in this file. Rainfall, stream discharge, and temperature data are examples of the types of data stored in the Unit Values File.

Ground-Water Site-Inventory File

This file is maintained within WATSTORE independent of the files discussed above, but it is cross-referenced to the Water-Quality File and to the Daily Values File. It contains inventory data about wells, springs, and other sources of ground water; the data included are site location and identification, geohydrologic characteristics, well-construction history, and one-time field measurements such as water temperature. The file is designed to accommodate 255 data elements and currently contains data for nearly 700,000 sites.

Water-Use File

Summary data on water use throughout the Nation are stored in this file.

Water Quality

Acronym: None
Media sampled to generate data: Surface water ocean and rivers
Type of data collection/monitoring: Ambient data collection
Data base status: Update terminated

ABSTRACT: Water Quality data of up to 2,200 parameters for South Atlantic and Eastern Gulf of Mexico and the Ohio River Basins, 1950 through 1977. Obtained from the U.S. Geological Survey.

Non-pollutant parameters include:
Biological data
Elevation
Flow rates
Geographic subdivision
Location
Physical data
Precipitation
Salinity
Temperature
weather
inorganic parameters
organic parameters
radio chemical

Ongoing study time period is 01/01/50 to 12/30/77
Termination of data collection: Occurred 05/30/79

Frequency of data collection: ten day samples

Total actual number of observations is 901305.

Data base includes: Raw data/observations

Total number of stations or sources covered is 7274.

Geographic coverage of data base: Geographic region South Atlantic, Eastern Gulf of Mexico, Ohio River Basin
Location identifiers of station/source for each record are:
State
County
City
Coordinates latitude and longitude
station ID number
Facility identifiers include: Not applicable
Pollutant identification data have: Storet parameter codes

Limitations: It is not known if EPA-approved or accepted lab analysis methods were used or if lab audit samples were satisfactorily analyzed.

Special study is the primary purpose for data collection.
Anticipatory/research is the secondary purpose for data collection.
No statutory requirement: Data collection requirement is Regional background analysis

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(June, 1980)

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AGRICOLA	National Agricultural Library (NAL)	Agriculture	1975 + /1970-74
ALCOHOL USE/ABUSE	Hazelden Foundation	Alcoholism	total online (1968 +)
BIOSIS PREVIEWS	BioSciences Information Services	Biological sciences	1978 + /1970-77
BOOKSINFO	Brodart, Inc.	800,000 books in print	total online
CA CONDENSATES	Chemical Abstracts Service	Chemistry	n.a./1970-76
CA SEARCH	Chemical Abstracts Service	Chemistry	total online (1977 +)
COMPUTER AND CONTROL ABSTRACTS	Institution of Electrical Engineers London, England	Computer & control engineering	1977 + /1970-76
DISSERTATION ABSTRACTS	University Microfilms	Multi-disciplinary	total online (1861 +)
DRUGINFO	University of Minnesota College of Pharmacy	Drug Abuse	total online (1968 +)
ELECTRICAL AND ELECTRONICS ABSTRACTS	Institution of Electrical Engineers London, England	Electrical & Electronic engineering	1977 + /1970-76
ENVIRONMENTAL IMPACT STATEMENTS	Information Resources Press	Environment	total online (1977 +)
ERIC	National Institute of Education	Education	total online (1966 +)
EXCEPTIONAL CHILD EDUCATION RESOURCES	Council for Exceptional Children	Exceptional child education	total online (1966 +)
FEDEX	U.S. Department of Energy	Energy Statistics	total online (1979 +)
GPO MONTHLY CATALOG*	U.S. Government Printing Office	Government publications	total online (1976 +)
INFORM	Data Courier, Inc.	Business	total online (1971 +)
MANAGEMENT CONTENTS	Management Contents, Inc.	Business	total online (1974 +)
MEDLARS	National Library of Medicine (NLM)	Medicine, nursing, dentistry	1978 + /1966-77
MEDOC	Eccles Health Sciences Library University of Utah	Government documents in health sciences	total online (1976 +)
NAL SERIALS	National Agricultural Library	NAL serial records	total online
NARIC	National Rehabilitation Information Center	Rehabilitation literature	total online (1956 +)
NIMIS	Nat'l Center of Educational Media and Materials for the Handicapped	Instructional materials for education of handicapped	total online
NIMH	National Institute of Mental Health	Mental health and related information	total online (1969 +)
NTIS	National Technical Information Service	Government reports, all areas	1975 + /1970-74
PAIS	Public Affairs Information Service	All social sciences	total online (1972 +)
PHARMACEUTICAL NEWS INDEX	Data Courier, Inc.	Drug industry news	total online (1974 +)
PHYSICS ABSTRACTS	Institution of Electrical Engineers	Physics	1977 + /1970-76
POLLUTION ABSTRACTS	Data Courier, Inc.	Pollution	total online (1970 +)
PREDICAST: PROMT**	Predicasts, Inc.	Business and economics	total online (1972 +)
PSYCHOLOGICAL ABSTRACTS	American Psychological Association	Psychology	total online (1967 +)
SOCIAL SCIENCE CITATION INDEX	Institute for Scientific Information	Social Science	1977 + /1972-76
SSIE	Smithsonian Science Information Exchange	Physical, social, engineering and life sciences	total online (1977 +)
US PATENTS	Pergamon International Information Corporation	All patents registered through U.S. Patent Office	total online (1860 +)

*These files are scheduled for availability by 3rd Quarter, 1980.

**All other Predicast databases are scheduled for 3rd Quarter, 1980.

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EPILEPSYLINE is sponsored by NIH's National Institute of Neurological and Communicative Disorders and Stroke. The file contains about 25,000 references and abstracts to articles on epilepsy that have been abstracted by Excerpta Medica.

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Occupational Resources

Occupational Injuries and Illnesses in 1979: Summary

U.S. Department of Labor
Raymond J. Donovan, Secretary
Bureau of Labor Statistics
Janet L. Norwood, Commissioner
April 1981

Bulletin 2097

Name of program or system	Agency	Purpose	Topical focus of data		Method of data collection	Population-location-time coverage	Method of data dissemination	Statistics generated
			Health	Environment or individual exposure				
Annual Occupational Injuries and Illness Survey	BLS	To provide data on work-related disease and injury.	Acute disease and acute injury by cause, with or without lost work days. Fact of death.	Industry. Establishment size.	Morbidity Record Survey. Probability sample of employers under OSHA recordkeeping, stratified by industry and establishment size.	Since 1972, ongoing surveys of nearly all private sector industries across the United States.	Tape. Publication.	Incidence of illness and injury by type of case per plant-hour worked.

For sale by the Superintendent of Documents, U.S. Government Printing Office
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Definitions

The definitions of occupational injuries and illnesses and lost workdays are from *Recordkeeping Requirements under the Occupational Safety and Health Act of 1970.*

Recordable occupational injuries and illnesses are:

1. Occupational deaths, regardless of the time between injury and death, or the length of the illness; or
2. Nonfatal occupational illnesses; or
3. Nonfatal occupational injuries which involve one or more of the following: Loss of consciousness, restriction of work or motion, transfer to another job, or medical treatment (other than first aid).

Occupational injury is any injury such as a cut, fracture, sprain, amputation, etc., which results from a work accident or from exposure involving a single incident in the work environment.

Occupational illness is any abnormal condition or disorder, other than one resulting from an occupational injury, caused by exposure to environmental factors associated with employment. It includes acute and chronic illnesses or disease which may be caused by inhalation, absorption, ingestion, or direct contact.

Lost workday cases are cases which involve days away from work, or days of restricted work activity, or both.

1. *Lost workday cases involving days away from work* are those cases which result in days away from work, or a combination of days away from work and days of restricted work activity.
2. *Lost workday cases involving restricted work activity* are those cases which result in restricted work activity only.

Lost workdays—away from work are the number of workdays (consecutive or not) on which the employee would have worked but could not because of occupational injury or illness.

Lost workdays—restricted work activity are the number of workdays (consecutive or not) on which, because of injury or illness:

1. The employee was assigned to another job on a temporary basis; or
2. The employee worked at a permanent job less than full time; or
3. The employee worked at a permanently assigned job but could not perform all duties normally connected with it.

The number of days away from work or days of restricted work activity does not include the day of injury or onset of illness or any days on which the employee would not have worked even though able to work.

Incidence rates represent the number of injuries and/or illnesses or lost workdays per 100 full-time workers and were calculated as: (N/EH) X 200,000 where:

N = number of injuries and/or illnesses or lost workdays
EH = total hours worked by all employees during calendar year.
200,000 = base for 100 full-time equivalent workers (working 40 hours per week, 50 weeks per year).

SAMPLE TABLE

Table 1. Continued—Occupational injury and illness incidence rates by industry, 1978 and 1979[1]

Industry 2/	SIC code 3/	1979 annual average employment (in thousands) 4/	Incidence rates per 100 full-time workers 5/							
			Total cases 6/		Lost workday cases		Nonfatal cases without lost workdays		Lost workdays	
			1978	1979	1978	1979	1978	1979	1978	1979
Books	273	103.4	7.2	7.3	2.7	2.9	4.5	4.4	36.6	39.4
Book publishing	2731	70.7	4.8	5.0	2.0	2.0	2.8	3.0	24.3	26.0
Book printing	2732	32.7	12.3	12.1	4.2	4.7	8.1	7.4	63.4	66.5
Miscellaneous publishing	274	45.7	2.7	3.2	1.2	1.5	1.5	1.7	19.0	20.8
Commercial printing	275	409.2	8.7	8.6	3.6	3.7	5.1	4.9	53.0	50.9
Commercial printing, letterpress	2751	167.4	7.7	8.1	3.3	3.5	4.4	4.6	50.8	49.3
Commercial printing, lithographic	2752	219.2	9.1	8.8	3.6	3.5	5.5	5.2	52.5	49.0
Engraving and plate printing	2753	n.a.	8.0	7.2	2.7	3.3	5.3	3.9	55.0	44.6
Commercial printing, gravure	2754	n.a.	16.0	15.2	8.4	8.0	7.6	7.2	94.5	113.1
Manifold business forms	276	46.7	11.7	13.1	4.9	5.6	6.7	7.5	57.4	69.4
Greeting card publishing	277	n.a.	6.4	6.4	2.7	2.8	3.7	3.6	32.4	39.5
Blankbooks and bookbinding	278	64.0	11.0	10.0	4.2	4.0	6.8	6.0	58.4	55.5
Blankbooks and looseleaf binders	2782	n.a.	10.7	9.8	4.3	3.8	6.4	6.0	52.6	52.2
Bookbinding and related work	2789	n.a.	11.4	10.2	4.0	4.3	7.3	5.9	67.5	61.0
Printing trade services	279	43.2	2.5	3.1	.9	1.2	1.6	1.9	14.1	22.6
Typesetting	2791	n.a.	1.6	2.3	.6	1.0	1.0	1.2	10.8	26.0
Photoengraving	2793	n.a.	3.2	3.9	1.3	1.2	1.9	2.7	15.2	17.3
Electrotyping and stereotyping	2794	n.a.	5.8	5.9	1.8	1.7	4.0	4.1	17.6	18.0
Lithographic platemaking services	2795	n.a.	4.3	4.8	1.4	1.7	2.9	3.1	24.9	17.0
Chemicals and allied products	28	1,110.7	7.8	7.7	3.3	3.5	4.5	4.2	50.9	54.9
Industrial inorganic chemicals	281	163.3	6.2	5.8	2.6	2.6	3.6	3.2	49.6	46.9
Alkalies and chlorine	2812	n.a.	5.1	4.8	2.4	2.4	2.7	2.4	54.9	44.2
Inorganic pigments	2816	n.a.	10.0	9.5	4.9	4.2	5.1	5.3	88.6	58.5
Industrial inorganic chemicals, n.e.c.	2819	106.7	5.9	5.3	2.2	2.3	3.7	3.0	40.7	43.3
Plastics materials and synthetics	282	211.3	5.7	5.4	2.3	2.4	3.4	3.0	35.8	41.4
Plastics materials and resins	2821	86.3	8.7	8.9	3.8	4.2	4.9	4.7	53.3	71.6
Cellulosic man-made fibers	2823	n.a.	-	2.9	-	1.1	-	1.8	-	25.3
Organic fibers, noncellulosic	2824	96.6	2.5	2.3	.8	.7	1.7	1.6	17.9	16.4
Drugs	283	193.4	6.7	7.0	3.0	3.4	3.7	3.6	42.7	47.3
Biological products	2831	n.a.	6.4	7.7	3.1	3.2	3.3	4.5	49.0	51.9
Medicinals and botanicals	2833	n.a.	7.1	8.8	4.0	4.0	3.1	4.7	58.2	54.1
Pharmaceutical preparations	2834	154.2	6.7	6.8	2.9	3.3	3.8	3.5	40.0	45.9
Soap, cleaners, and toilet goods	284	139.0	9.8	9.7	4.5	4.8	5.3	4.9	68.0	71.5
Soap and other detergents	2841	41.2	8.7	9.3	4.5	4.7	4.1	4.6	69.1	77.9
Polishes and sanitation goods	2842	n.a.	12.8	12.7	5.2	6.1	7.6	6.6	81.8	81.7
Surface active agents	2843	n.a.	14.2	9.8	5.9	4.9	8.3	4.9	78.9	64.7
Toilet preparations	2844	58.0	8.5	8.2	3.9	4.0	4.6	4.2	58.2	61.5
Paints and allied products	285	68.8	14.3	13.4	6.0	5.9	8.2	7.5	78.1	81.2
Industrial organic chemicals	286	171.7	6.2	5.7	2.5	2.5	3.7	3.2	41.4	46.6
Gum and wood chemicals	2861	n.a.	9.2	9.7	4.0	4.5	5.2	5.2	64.3	71.2
Cyclic crudes and intermediates	2865	37.2	9.9	7.7	3.8	3.3	6.0	4.3	63.1	58.8
Industrial organic chemicals, n.e.c.	2869	n.a.	5.0	4.9	2.1	2.1	2.9	2.8	33.8	41.6
Agricultural chemicals	287	69.9	9.1	9.9	3.6	4.2	5.5	5.6	56.7	62.3
Nitrogenous fertilizers	2873	n.a.	7.8	9.0	2.9	3.1	4.9	5.9	43.1	50.2
Phosphate fertilizers	2874	n.a.	8.4	7.9	2.9	3.1	5.5	4.8	62.0	54.3
Fertilizers, mixing only	2875	n.a.	13.4	13.0	4.8	5.4	8.6	7.6	79.5	85.8
Agricultural chemicals, n.e.c	2879	n.a.	7.9	9.8	3.7	4.9	4.2	4.9	49.4	61.1
Miscellaneous chemical products	289	93.4	11.6	12.8	5.1	5.9	6.5	6.9	73.4	81.8
Adhesives and sealants	2891	n.a.	14.2	16.2	5.9	7.9	8.3	8.3	81.8	83.4
Explosives	2892	n.a.	5.7	5.7	2.4	2.2	3.3	3.5	53.1	45.0
Printing ink	2893	n.a.	13.4	13.5	5.3	5.9	8.1	7.6	71.4	91.1
Carbon black	2895	n.a.	7.3	8.1	4.3	4.3	3.0	3.8	86.5	88.8
Chemical preparations, n.e.c	2899	n.a.	12.4	13.6	5.6	6.3	6.8	7.3	75.8	88.9
Petroleum and coal products	29	210.0	7.9	7.7	3.4	3.6	4.5	4.1	58.3	62.0
Petroleum refining	291	165.4	6.0	5.6	2.7	2.7	3.3	2.9	46.0	46.0
Paving and roofing materials	295	32.6	14.4	15.6	5.7	6.9	8.7	8.7	105.7	122.0
Paving mixtures and blocks	2951	n.a.	11.1	14.0	4.1	5.8	7.0	8.1	71.4	95.3
Asphalt felts and coatings	2952	n.a.	16.3	16.4	6.6	7.4	9.7	8.9	125.8	135.6
Miscellaneous petroleum and coal products	299	n.a.	16.6	15.3	7.1	7.3	9.5	8.0	92.1	112.8
Lubricating oils and greases	2992	n.a.	13.8	14.9	5.9	7.3	7.9	7.6	79.0	117.1
Petroleum and coal products, n.e.c	2999	n.a.	27.2	17.3	11.4	7.3	15.7	10.0	140.9	90.0

footnotes described in resource text

Name of program system	Agency	Purpose	Topical focus of data		Method of data collection	Population-location-time coverage	Method of data dissemination	Statistics generated
			Health	Environment or individual exposure				
Cross Sectional Industrial Studies	NIOSH	To understand relationship between type of industry and illness of reproductive system.	Physical symptoms.	Occupational history. Current levels of selected pollutants proximal to worker	Cohort studies. Exposed and control groups are selected. Interviews with all employees and in some cases medical examinations are conducted.	Series of industrywide studies, beginning in 1971.	Special reports.	Relative risk statistics. Morbidity rates. Average exposure to selected pollutants.

Name of program or system	Agency	Purpose	Topical focus of data		Method of data collection	Population-location-time coverage	Method of data dissemination	Statistics generated
			Health	Environment or individual exposure				
Health Effects Evaluation Data Base	NIOSH	To summarize information obtained from hazard evaluations (HE) requested by employees or employers under the Occupational Safety and Health Act.	Symptoms and medical test results from workers examined during the HE.	Location and name of establishment, Standard Industrial Classification (SIC), hazards, occupations observed, results of environmental samples taken.	Inspection by industrial hygienists and occupational health physician specialists.	Nationwide, 1977-78. A total of 260 HE's are in this file.	Special request reports. Publications.	For internal use.

NOHS

Scope:

The National Occupational Hazard Survey (NOHS) was a two-year study, initiated in 1972, which intended to describe the health and safety conditions in the American work environment and, more specifically, to determine the extent of worker exposure to chemical and physical agents. The businesses participating in the survey were selected by the Bureau of Labor Statistics and consisted of approximately 4,750 establishments in 67 metropolitan areas throughout the United States. This sample was chosen to be representative of all non-agricultural businesses covered under the Occupational Safety and Health Act of 1970. Each of the selected business establishments was visited by a member of a professionally trained survey team, where the survey itself consisted of two major parts. In the first part, appropriate management personnel were interviewed, using as the basis of the interview a standard set of 50 questions regarding facility policies and conditions relevant to employee safety and health. In the second part, a walkthrough investigation of the facility was conducted. In this walkthrough potential hazards were noted, the occupational titles of the people exposed were coded, and the intended control procedures utilized in connection with the hazard were recorded. A three volume NIOSH publication, the National Occupational Hazard Survey, describes the survey itself (Volume I - Survey manual), and the subsequent database and retrieval system development (Volume II - Data Editing and Database Development), and provides tabular compilations of some of the database statistics (Volume III -Survey Analysis and Supplemental Tables).

Access:

Single copies of the published documents can be obtained by sending a self-addressed mailing label to:

Publications Dissemination
Division of Technical Services
NIOSH
4676 Columbia Parkway
Cincinnati, OH 45226

Reference: DHEW (NIOSH) Publication Nos.
74-127, 77-123, and 78-114

For additional information concerning the contents of this database contact:

Joseph Seta
Surveillance Branch (F3)
National Institute for Occupational
Safety and Health
4676 Columbia Parkway
Cincinnati, OH 45226 Telephone: (513) 684-2706

Name of program or system	Agency	Purpose	Topical focus of data		Method of data collection	Population-location-time coverage	Method of data dissemination	Statistics generated
			Health	Environment or individual exposure				
Occupational Hazard Exposure Registry	NIOSH	To provide surveillance of workers exposed to workplace hazards, e.g., kepone.	Presence of expected health effects.	Type of industry and work history indicating potential and actual exposure.	Registry. Continuing search for high-risk groups.	Nationwide effort started in 1976.	None.	Cause specific mortality.

Name of program or system	Agency	Purpose	Topical focus of data		Method of data collection	Population-location-time coverage	Method of data dissemination	Statistics generated
			Health	Environment or individual exposure				
Occupationally Related Disease Case Registers	NIOSH	To provide data on the changing incidence and prevalence of occupationally related disease.	Vital and general health status. Occurrence of hepatic angiosarcoma; occurrence of beryllium related disease.	Record of PVC exposure by job history Record of beryllium exposure by job history.	National case finding efforts. Submission of case reports from medical community. Related to Hepatic Angiosarcoma Case Finding Effort (table	80 cases of angiosarcoma reported for 1974-80. 880 cases of beryllosis reported between 1951 and 1980.	Publications in preparation.	Changes in incidence and prevalence over the years.

Name of program or system	Agency	Purpose	Topical focus of data		Method of data collection	Population-location-time coverage	Method of data dissemination	Statistics generated
			Health	Environment or individual exposure				
Outcome Studies of Workers in Selected Industries or Occupations	NIOSH	To understand relationship between type of industry or specific exposures and causes of death.	Cause of death.	Occupation, industry, chemical or physical agent.	Cohort studies. Plants with high-risk characteristics are selected. All workers in a defined cohort are selected for study.	Series of industrywide studies, beginning in 1971.	Special reports.	Risk statistics. Mortality rates. Average exposure to selected pollutants.

Name of program or system	Agency	Purpose	Topical focus of data		Method of data collection	Population-location-time coverage	Method of data dissem-ination	Statistics generated
			Health	Environment or individual exposure				
BLS Statistical Record-keeping System	BLS	To provide registration of occupational illness and injury at the employer level.	Fatalities. Disease and injury by cause.	Industry.	Registry. Log and summary of occupational injury and illness are maintained. Supplementary record on each case.	Since 1971, logs have been maintained by all nonfarm employers of more than 10 people nationwide.	Publication.	Incidence of injury and illness by cause per 100 workers.

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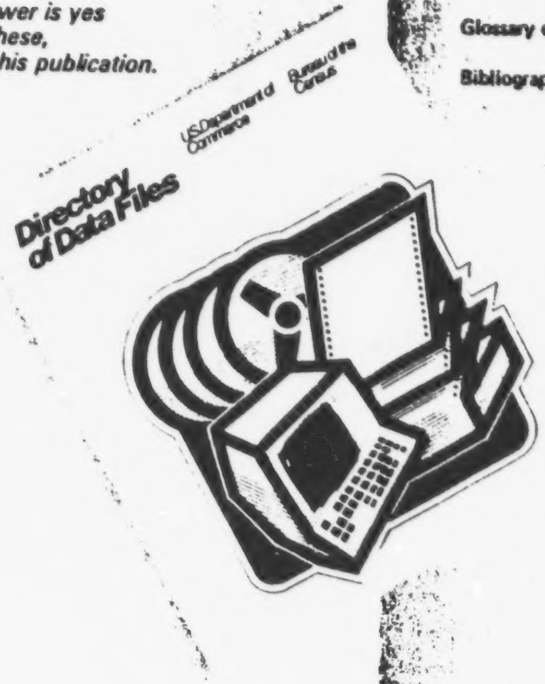

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National Electronic Injury Surveillance System

Acronym: NEISS
Media sampled to generate data: sample is hospital emergency rooms which treat pesticide poisonings.
Type of data collection/monitoring: monitoring of injuries (pesticide poisonings) treated in hospital emergency rooms.
Data base status: Operational/ongoing

ABSTRACT: NEISS consists of a listing of pesticide poisoning incidents giving information on type of pesticide, route of exposure, whether or not the case was diagnosed as a poisoning by a physician, what symptoms, if any, were present, the brand name of the pesticide, and the EPA registration number of the product, if known.

Non-pollutant parameters include:
- Exposure data
- Health effects
- Location
- Population demographics
- Sampling date
- Treatment devices
- pesticide type
- route of exposure
- physician diagnosis of poisoning
- symptoms present
- age & sex of patient
- disposition of case
- body part affected
- EPA regulation number

Ongoing study time period is 01/01/79 to 09/30/80 (present)
Termination of data collection: Not anticipated

Frequency of data collection: Monthly reports by Consumer Product Safety Commission to EPA

Total estimated number of observations is 21067.
Estimated annual increase of observations is 18500.

Data base includes: Raw data/observations
Summary or aggregate observations

Total number of stations or sources covered is 74.
Number currently contributing data is 51.
Number of facilities covered is 74.

Geographic coverage of data base: National
Location identifiers of station/source for each record are: County
State

Pesticide Incident Monitoring System

Acronym: PIMS

Media sampled to generate data:
- Air
- Blood
- Drinking water
- Ground water
- Runoff agricultural
- Sediment
- Soil
- Tissue human, animal, fish

Type of data collection/monitoring: data collection or monitoring is often determined by the nature of the incident.

Data base status: Operational/ongoing

ABSTRACT: The Pesticide Monitoring System (PIMS) enters, stores, coordinates and retrieves pesticide incident data within the EPA. The system develops and maintains reporting sources, monitors suspected incidents and provides confirmatory analysis and data on circumstances of the incident.

Non-pollutant parameters include:
- Biological data
- Chemical data
- Collection method
- Concentration measures
- Disposal
- Exposure data
- Geographic subdivision
- Health effects
- Industry
- Location
- Manufacturer
- Physical data
- Precipitation
- Sampling date
- Site description
- Use
- Wind direction
- Wind velocity
- Some application methods
- Rates

Ongoing study time period is 01/01/66 to 09/30/80 (present)
Termination of data collection: Not anticipated

Frequency of data collection: varies as incidents are reported-may be as frequently as daily.

Total actual number of observations is 41000.
Estimated annual increase of observations is 4000.

Soil, Water, Estuarine Monitoring System

Acronym: SWEMS
Media sampled to generate data: Soil
Tissue agricultural crops
Type of data collection/monitoring: Ambient data collection
Data base status: Operational/ongoing

ABSTRACT: The soils section of the SWEMS system contains residue data for agricultural and urban soils, raw agricultural crops, and agricultural chemical application data for the sites sampled. These data may be summarized in several ways: by material, by state, by crop, by urban area (for urban soils).

Non-pollutant parameters include: Sampling date
Site description

Ongoing study time period is 05/01/68 to 09/30/80 (present)
Termination of data collection: Not anticipated

Frequency of data collection: annually urban soil only

Total estimated number of observations is 12500.
Estimated annual increase of observations is 500.

Data base includes: Raw data/observations
Summary or aggregate observations

Total number of stations or sources covered is 9000.
Number currently contributing data is 3000.

Geographic coverage of data base: National
Location identifiers of station/source for each record are: State
County
SMSA
Project identifier
Pollutant identification data are: Coded with other coding schemes

Limitations: Agricultural data collected only 1968-1973. 1973 (FY '74) data is a six-year schedule, so 2 sets of data (different years) are available for most SMSAs. Data has been automated through part of 1978. 1979 data has been analyzed but not automated. 1980 samples are currently being analyzed.

Risk assessment is the primary purpose for data collection.
Trend assessment is the secondary purpose for data collection.
Program evaluation is the third purpose for data collection.
Statutory authorization is P L 94-469, section 10 P L 92-516, as amended, Section 20(c)
Confidentiality: No limits on access to data
Primary physical location of data: Headquarters office
Form of data storage: Magnetic tape
Data access: EPA software Special program MIDSD system number: 7501300900
EPA hardware IBM 370/168

Resource Name: VAX Databases

Acronym: None

Contact: Bill Wood
382-3928

Description: Environmental fate models, databases in comparison populations, chemical specific data, chemical property estimates, statistical and graphical systems. Most are in or will be included in the Graphical Exposure Modeling System (GEMS).

Manual or Automated: Automated

Status: Operational, enhancement on-going

Location: VAX 11/780

Number of Records: Variable

Direct or Indirect Access by User: Direct

User Interacts with Resource Through: On-line interactive

Who Designed Resource: Contractor (General Software Corporation)

Designed for Which Organizational Unit(s): EED

Relationship of OTS to Resource: OTS developed, maintains and operats with extramural support for its own use.

Which OTS Programs are Supported by the Resource: All 5--for exposure assessments

Which Organizational Units Currently Use: EED principal user (also available to other EPA offices as well as other agencies)

Which Organizational Unit Sets Policy for Resource: EED

Who Operates and Maintains: EED

PROFILE OF VAX DATABASE

Resource Name: Meteorological (STAR) Data (STAR = Stability Tubular Array)

Acronym: STAR

Description: STAR data consists of wind speed vs. wind direction frequently for up to 7 atmospheric stability classes compiled from over 300 weather stations in the continental U.S. Data are used as input for climate logical atmospheric models like ATM which estimate ground level concentrations in all directions around a release point rather than just in the prevailing wind direction.

PROFILE OF VAX DATABASE

Resource Name: Needs Survey Data

Acronym: None

Description: The 1980 Needs Survey, conducted by the EPA Office of Water Program Operations, characterized most publicly owned treatment works (POTWs), primarily sewage treatment plants, in the United States. This file contains data on the flow rates and treatment procedures of POTW's together with the sizes of populations served by the plants. These data are used to estimate the removal efficiencies of the treatment procedures for chemicals in order to obrain waterborne release and concentration estimates. The data file has not yet been integrated into GEMS, but can be used with specific retrieval software.

PROFILE OF VAX DATABASE

Resource Name:	Geoecology Data Base
Acronym:	None
Description:	This Database contains county level data on a variety of environmental parameters. Categories include terrain, soils, water resources, forestry, vegetation, agriculture, land use, wildlife, climate, natural areas and endangered species. Data is planned for use with the SESOIL and other models and exposure analyses for which county level (i.e., not site specific data may be appropriate). (Note: this is only partially implemented--approximately 18 of 64 subfiles--as of October 1982.)

APPENDIX B

Chemicals Studied and Regulated by RCRA, CAA, CWA, OSHA, and NIOSH

This appendix lists the chemicals regulated by the Resource Conservation and Recovery Act (RCRA), the Clean Air Act (CAA), and Clean Water Act (CWA), the Occupational Safety and Health Administration (OSHA), and the National Institute for Occupational Safety and Health (NIOSH). This appendix was compiled so that it could be quickly scanned to see if a toxic chemical or a similar chemical is regulated. If it is regulated, then exposure assessment information of the chemical may be available from the regulating agency.

Table B-1 is a checklist from an EPA questionnaire used in the EPA Environmental Data Base Survey. The survey determined the available environmental data bases and models and the information they contained. Table B-1 further groups the pollutants into categories corresponding to legislative or regulatory requirements and selected monitoring lists. In response to the questionnaire, the categories were checked which best reflected the actual observations contained in the data base. Table B-1 can be used to find out the category to which the chemical belongs; the data base survey can be used to find out where the available data bases are located.

The RCRA hazardous waste list has been updated since Table B-1 was created in 1979. Table B-2 contains the current list from the May 1980 Federal Register. Table B-3 presents the hazardous waste generating operations which are regulated by RCRA. These operations have been analyzed in hazardous waste background documents which have valuable materials balance information.

Tables B-4 and B-5 are lists of chemicals regulated by OSHA and NIOSH. Documents have been written by OSHA and NIOSH on the industries using these chemicals. If the chemical or a similar chemical is contained in these lists, the publication bibliographies of OSHA and NIOSH should be searched.

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Table B-1

Chemicals Governed by RCRA, CWA and CAA
Source: Environmental Data Base Survey. 1980
EPA Information Clearinghouse, Office of Planning and Management, U.S. Environmental Protection Agency, Washington, D.C.

CHEMICAL ABSTRACT NUMBER	CHEMICAL	RCRA Hazardous Wastes	43 Air Priority Pollutants	6 NESHAPS Standards	7 NAAQS Criteria Pollutants	18 Radioactive Pollutants	129 Water Priority Pollutants	11 Conventional Water Pollutants	21 Drinking Water Standards	9 Potential DW Standards	299 Section 311 Hazardous	40 RPARS & Cancelled Pesticides	9 Monitored Pesticides	54 TSCA Assessment & Section 4	16 Pre-RPAR Review	41 Potential Water Criteria	15 Metals	20 Drinking Water Monitoring	3 Section 111D Air Pollutants
83-32-9	Acenaphthene						X												
208-96-8	Acenaphthylene						X												
75-07-0	Acetaldehyde	X	X								X			X					
64-19-7	Acetic acid										X								
108-24-7	Acetic anhydride										X								
67-64-1	Acetone	X														X			
75-86-5	Acetone cyanohydrin										X								
75-05-8	Acetonitrile	X																	
98-86-2	Acetophenone	X																	
	2-Acetylaminoflourene	X																	
506-96-7	Acetyl bromide										X								
75-36-5	Acetyl chloride	X									X								
	Acidity							X											
	Acid mist																		X
107-02-8	Acrolein	X	X				X				X			X					
79-06-1	Acrylamide	X																	
79-10-7	Acrylic acid	X																	
107-13-1	Acrylonitrile	X	X				X				X	X		X					
124-04-9	Adipic acid										X								
15972-60-8	Alachlor																	X	
309-00-2	Aldrin	X					X				X	X							
	Alkalinity							X											
	n-alkanes (C_{10} - C_{30})															X			
107-18-6	Allyl alcohol	X									X								
107-05-1	Allyl chloride		X								X								
7429-90-5	Aluminum															X			
20859-73-8	Aluminum phosphide	X																	
10043-01-3	Aluminum sulfate										X								
2763-96-4	5-(Aminomethyl)-3-isoxazolol	X																	
504-24-5	4-Aminopyridine	X																	
	6-Amino-1,1a,2,8,8a,8b-hexahydro-8-(hydroxymethyl)8-methoxy-5-methyl-carbamate azirino (2',3':3,4)pyrrolo (1,2-a) indole-4,7-dione (ester)	X																	
33089-61-1	Amitraz (Baam)											X							
61-82-5	Amitrole	X																	
7664-41-7	Ammonia										X					X			
631-61-8	Ammonium acetate										X								
1863-63-4	Ammonium benzoate										X								
1066-33-7	Ammonium bicarbonate										X								
7789-09-5	Ammonium bichromate										X								
1341-49-7	Ammonium bifluoride										X								
10192-30-0	Ammonium bisulfite										X								
1111-78-0	Ammonium carbamate										X								
506-87-6	Ammonium carbonate										X								
12125-02-9	Ammonium chloride										X								
7788-98-9	Ammonium chromate										X								
7632-50-0	Ammonium citrate										X								
13826-83-0	Ammonium fluoborate										X								
12125-01-8	Ammonium fluoride										X								
1336-21-6	Ammonium hydroxide										X								

CHEMICAL ABSTRACT NUMBER	CHEMICAL	RCRA Hazardous Wastes	43 Air Priority Pollutants	5 NESHAPS Standards	7 NAAQS Criteria Pollutants	18 Radioactive Pollutants	129 Water Priority Pollutants	11 Conventional Water Pollutants	21 Drinking Water Standards	9 Potential DW Standards	299 Section 311 Hazardous	48 RPARS & Cancelled Pesticides	9 Monitored Pesticides	54 TSCA Assessment & Section 4	16 Pre-RPAR Review	41 Potential Water Criteria	15 Metals	29 Drinking Water Monitoring	3 Section 111D Air Pollutants
1113-38-8	Ammonium oxalate										X								
131-74-8	Ammonium picrate	X																	
16919-19-0	Ammonium silicofluoride										X								
7773-06-0	Ammonium sulfamate										X								
12135-76-1	Ammonium sulfide										X								
10196-04-0	Ammonium sulfite										X								
3164-29-2	Ammonium tartrate										X								
1762-95-4	Ammonium thiocyanate										X								
7783-18-8	Ammonium thiosulfate										X								
628-63-7	Amyl acetate										X								
62-53-3	Aniline	X									X								
120-12-7	Anthracene						X												
7440-36-0	Antimony						X							X					
7647-18-9	Antimony pentachloride										X								
11071-15-1	Antimony potassium tartrate										X								
7789-61-9	Antimony tribromide										X								
10025-91-9	Antimony trichloride										X								
7783-56-4	Antimony trifluoride										X								
1309-64-4	Antimony trioxide										X								
140-57-8	Aramite											X							
7440-38-2	Arsenic						X		X			X		X			X		
1327-52-2	Arsenic acid	X										X							
1303-32-8	Arsenic disulfide										X								
1303-28-2	Arsenic pentoxide	X									X	X							
7784-34-1	Arsenic trichloride										X								
1327-53-3	Arsenic trioxide	X									X	X							
1303-33-9	Arsenic trisulfide										X								
1332-21-4	Asbestos	X		X			X							X					
1912-24-9	Atrazine																	X	
2465-27-2	Auramine	X																	
115-02-6	Azaserine	X																	
319-84-6	BHC-Alpha						X												
319-85-7	BHC-Beta						X												
58-89-9	BHC (lindane)-Gamma						X												
319-86-8	BHC-Delta						X												
1918-00-9	Banvel-D																	X	
7440-39-3	Barium								X							X	X		
14798-08-4	Barium 140					X													
542-62-1	Barium cyanide	X									X								
1861-40-1	Benefin																	X	
17804-35-2	Benomyl											X							
225-51-4	Benz[c]acridine	X																	
98-87-3	Benzal chloride	X																	
50-31-7	Benzac											X							
71-43-2	Benzene	X		X			X				X			X					
98-09-9	Benzenesulfonyl chloride	X																	
108-98-5	Benzenethiol	X																	
92-87-5	Benzidine	X					X							X					
56-55-3	Benzo(a)anthracene	X					X												
205-99-2	3,4-Benzofluoranthene						X												

CHEMICAL ABSTRACT NUMBER	CHEMICAL	RCRA Hazardous Wastes	43 Air Priority Pollutants	8 NESHAPS Standards	7 NAAQS Criteria Pollutants	18 Radioactive Pollutants	129 Water Priority Pollutants	11 Conventional Water Pollutants	21 Drinking Water Standards	9 Potential DW Standards	299 Section 311 Hazardous	48 RPARS & Cancelled Pesticides	9 Monitored Pesticides	64 TSCA Assessment & Section 4	16 Pre RPAR Review	41 Potential Water Criteria	15 Metals	29 Drinking Water Monitoring	3 Section 111D Air Pollutants
207-08-9	Benzo(k)fluoranthene						X												
65-85-0	Benzoic acid										X								
100-47-0	Benzonitrile										X								
191-24-2	Benzo(g,h,i)perylene						X												
50-32-8	Benzo[a]pyrene	X					X												
98-07-7	Benzotrichloride	X																	
98-88-4	Benzoyl chloride										X								
100-44-7	Benzyl chloride		X								X			X					
7440-41-7	Beryllium			X			X										X		
7787-47-5	Beryllium chloride										X								
	Beryllium dust	X																	
7787-49-7	Beryllium fluoride										X								
13597-99-4	Beryllium nitrate										X								
92-52-4	Biphenyl															X			
111-91-1	Bis(2-chloroethoxy)methane	X					X												
111-44-4	Bis(2-chloroethyl)ether	X					X												
494-03-1	N,N-Bis(2-chloroethyl)-2-naphthylamine	X																	
39638-32-9	Bis(2-chloroisopropyl)ether	X					X												
542-88-1	Bis(chloromethyl)ether	X	X				X												
117-81-7	Bis(2-ethylhexyl)phthalate	X					X												
7440-69-9	Bismuth and compounds															X			
7440-42-8	Boron and compounds															X			
7726-95-6	Bromine															X			
598-31-2	Bromoacetone	X																	
108-86-1	Bromobenzene																	X	
28906-38-9	Bromochlorobenzene																	X	
75-27-4	Bromodichloromethane																	X	
74-83-9	Bromomethane	X					X												
101-55-3	4-Bromophenyl phenyl ether	X					X												
357-57-3	Brucine	X																	
23184-66-9	Butachlor																	X	
1338-23-4	2-Butanone peroxide	X																	
123-86-4	Butyl acetate										X								
71-36-3	n-Butyl alcohol	X																	
109-73-9	Butylamine										X								
85-68-7	Butyl benzyl phthalate						X												
88-85-7	2-sec Butyl-4,6-dinitrophenol	X																	
84-74-2	N-Butyl phthalate										X								
107-92-6	Butyric acid										X								
75-60-5	Cacodylic acid and salts														X				
7440-43-9	Cadmium						X		X			X		X			X		
543-90-8	Cadmium acetate										X								
7789-42-6	Cadmium bromide										X								
1018-64-2	Cadmium chloride										X								
7778-44-1	Calcium arsenate										X								
52740-16-6	Calcium arsenite										X								
75-20-7	Calcium carbide										X								
13765-19-0	Calcium chromate	X									X								
592-01-8	Calcium cyanide	X									X								
26264-06-2	Calcium dodecylbenzenesulfonate										X								
1305-62-0	Calcium hydroxide										X								

CHEMICAL ABSTRACT NUMBER	CHEMICAL	RCRA Hazardous Wastes	43 Air Priority Pollutants	5 NESHAPS Standards	7 NAAQS Criteria Pollutants	18 Radioactive Pollutants	129 Water Priority Pollutants	11 Conventional Water Pollutants	21 Drinking Water Standards	9 Potential DW Standards	299 Section 311 Hazardous	48 RPARS & Cancelled Pesticides	8 Monitored Pesticides	54 TSCA Assessment & Section 4	18 Pre-RPAR Review	41 Potential Water Criteria	15 Metals	29 Drinking Water Monitoring	3 Section 111D Air Pollutants
7778-54-3	Calcium hypochlorite										X								
1305-78-8	Calcium oxide										X								
133-06-2	Captan										X				X				
63-25-2	Carbaryl										X				X				
1563-66-2	Carbofuran										X		X						
14762-75-5	Carbon 14					X													
75-15-0	Carbon disulfide	X									X								
630-08-0	Carbon monoxide				X														
56-23-5	Carbon tetrachloride		X				X			X	X				X				
353-50-4	Carbonyl fluoride	X																	
10045-97-3	Cesium 137					X													
107-20-0	Chloroacetaldehyde	X																	
75-87-6	Chloral	X																	
305-03-3	Chlorambucil	X																	
118-75-2	Chloranil											X							
57-74-9	Chlordane	X					X				X	X							
various	Chlorinated ethanes													X					
various	Chlorinated naphthalenes													X					
7782-50-5	Chlorine										X					X			
106-47-8	p-Chloroaniline	X																	
108-90-7	Chlorobenzene	X	X				X			X	X								
510-15-6	Chlorobenzilate	X										X							
	1-(p-Chlorobenzoyl)-5-methoxy-2-methylindole-3-acetic acid	X																	
124-48-1	Chlorodibromomethane	X					X											X	
106-89-8	1-Chloro-2,3-epoxypropane	X																	
75-00-3	Chloroethane						X							X					
75-01-4	Chloroethene	X																	
110-75-8	Chloroethyl vinyl ether	X																	
110-75-8	2-Chloroethylvinyl ether						X												
	Chlorofluorocarbons													X					
67-66-3	Chloroform	X	X				X				X	X		X					
59-50-7	p-Chloro-m-cresol	X					X												
74-87-3	Chloromethane	X					X							X					
107-30-2	Chloromethyl methyl ether	X																	
91-58-7	2-Chloronaphthalene	X					X												
95-57-8	2-Chlorophenol	X					X												
7005-72-3	4-Chlorophenyl phenyl ether						X												
5344-82-1	1-(o-Chloropehnyl)thiourea	X																	
126-99-8	Chloroprene		X											X					
542-76-7	3-Chloropropionitrile	X																	
7790-94-5	Chlorosulfonic acid										X								
100-44-7	alpha-Chlorotoluene	X																	
3165-93-3	4-Chloro-o-toluidine hydrochloride	X																	
2921-88-2	Chlorpyrifos										X		X						
1066-30-4	Chromic acetate										X								
7738-94-5	Chromic acid										X								
10101-53-8	Chromic sulfate										X								
7440-47-3	Chromium						X		X					X			X		
10049-05-5	Chromous chloride										X								

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218-01-9	Chrysene	X					X												
8007-45-2	Coal tar											X							
7440-48-4	Cobalt															X	X		
7789-43-7	Cobaltous bromide										X								
544-18-3	Cobaltous formate										X								
	Cobaltous sulfamate										X								
7550-50-8	Copper						X										X		
544-92-3	Copper cyanide	X																	
56-72-4	Coumaphos										X								
8021-39-4	Creosote											X							
1319-77-3	Cresol										X								
95-48-7	o-Cresol		X											X					
108-39-4	m-Cresol		X											X					
106-44-5	p-Cresol		X											X					
1319-77-3	Cresylic acid	X																	
4170-30-3	Crotonaldehyde	X									X								
98-82-8	Cumene	X																	
142-71-2	Cupric acetate										X								
12002-03-8	Cupric acetoarsenite										X								
7447-39-4	Cupric chloride										X								
3251-23-8	Cupric nitrate										X								
814-91-5	Cupric oxalate										X								
7758-98-7	Cupric sulfate										X								
10380-29-7	Cupric sulfate ammoniated										X								
815-82-7	Cupric tartrate										X								
21725-46-2	Cyanazine																	X	
57-12-5	Cyanide	X					X												
460-19-5	Cyanogen	X																	
506-68-3	Cyanogen bromide	X																	
506-77-4	Cyanogen chloride	X									X								
110-82-7	Cyclohexane	X									X								
108-94-1	Cyclohexanone	X																	
131-89-5	2-Cyclohexyl-4,6-dinitrophenol	X																	
50-18-0	Cyclophosphamide	X																	
94-75-7	2,4-D acid										X		X			X			
various	2,4-D esters										X								
various	DDD(TDE)	X										X							
72-54-8	4,4'-DDD(p,p'-TDE)						X												
72-55-9	4,4'-DDE(p,p'-DDX)						X												
various	DDT	X									X	X							
50-29-3	4,4'-DDT						X												
20830-81-3	Daunomycin	X																	
8065-48-3	Demeton															X			
	Dialkyl ethers															X			
	Dialkyl phosphates												X						
2303-16-4	Diallate	X										X							
333-41-5	Diazinon										X								
53-70-3	Dibenzo[a,h]anthracene	X					X												
132-64-9	Dibenzofuran															X			
189-55-9	Dibenzol[a,i]pyrene	X																	
124-48-1	Dibromochloromethane	X																	

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96-12-8	1,2-Dibromo-3-chloropropane (DBCP)	X										X							
106-93-4	1,2-Dibromoethane	X												X					
74-95-3	Dibromomethane	X																	
84-74-2	Dibutyl phthalate																	X	
84-74-2	Di-n-butyl phthalate	X					X												
1918-00-9	Dicamba										X		X						
1194-65-6	Dichlobenil										X								
117-80-6	Dichlone										X								
25321-22-6	Dichlorobenzene										X								
106-46-7	p-Dichlorobenzene		X																
95-50-1	1,2-Dichlorobenzene	X					X			X				X					
541-73-1	1,3-Dichlorobenzene	X					X			X				X					
106-46-7	1,4-Dichlorobenzene	X					X			X				X					
91-94-1	3,3'-Dichlorobenzidine	X					X												
75-27-4	Dichlorobromomethane						X												
110-57-6	1,4-Dichloro-2-butene	X																	
75-71-8	Dichlorodifluoromethane	X					X												
75-34-3	1,1-Dichloroethane	X					X							X					
107-06-2	1,2-Dichloroethane	X					X			X				X					
75-35-4	1,1-Dichloroethylene	X					X												
156-59-2	cis-1,2-Dichloroethylene																	X	
156-60-5	1,2-trans-Dichloroethylene	X					X											X	
594-04-7	Dichloroiodomethane																	X	
75-09-2	Dichloromethane	X	X				X							X					
120-83-2	2,4-Dichlorophenol	X					X												
87-65-0	2,6-Dichlorophenol	X																	
94-75-7	2,4-Dichlorophenoxyacetic acid (2,4-D)	X							X										
696-28-6	Dichlorophenylarsine	X																	
	Dichloropropene & Dichloropropane mixture										X								
78-87-5	1,2-Dichloropropane	X					X							X					
542-75-6	1,3-Dichloropropene	X																	
75-99-0	2,2-Dichloropropionic acid										X								
542-75-6	1,2-Dichloropropylene						X												
62-73-7	Dichlorvos (DDVP)										X				X				
60-57-1	Dieldrin	X					X				X	X							
1464-53-5	Diepoxybutane	X																	
109-89-7	Diethylamine										X								
	Diethylarsine	X																	
1615-80-1	1,2-Diethylhydrazine	X																	
	O,O-Diethyl-s-(2-ethylthio)ethyl) ester of phosphorothioic acid	X																	
	O,O-Diethyl-s-methyl ester of phosphorodithioic acid	X																	
297-97-2	O,O-Diethyl-O-(2-pyrazinyl)phosphorothioate	X																	
311-45-5	O,O-Diethyl phosphoric acid, O-p-nitrophenyl ester	X																	
84-66-2	Diethyl phthalate	X					X											X	
56-53-1	Diethylstilbestrol	X																	
94-58-6	Dihydrosafrole	X																	

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	3,4 Dihydroxy-alpha-(methylamino)-methyl benzyl alcohol	X																	
55-91-4	Di-isopropylfluorophosphate	X																	
60-51-5	Dimethoate	X										X							
119-90-4	3,3'-Dimethoxybenzidine	X																	
39196-18-4	3,3-Dimethyl-1(methylthio)-2-butanone-O-[(methylamino) carbonyl]oxime	X																	
124-40-3	Dimethylamine	X									X								
60-11-7	p-Dimethylaminoazobenzene	X																	
57-97-6	7,12-Dimethylbenz[a]anthracene	X																	
119-93-7	3,3'-Dimethylbenzidine	X																	
80-15-9	alpha,alpha-Dimethylbenzylhydroperoxide	X																	
79-44-7	Dimethylcarbamoyl chloride	X																	
57-14-7	1,1-Dimethylhydrazine	X																	
540-73-8	1,2-Dimethylhydrazine	X																	
62-75-9	Dimethylnitrosoamine	X	X																
122-09-8	alpha,alpha-Dimethylphenethylamine	X																	
105-67-9	2,4-Dimethylphenol	X					X												
131-11-3	Dimethyl phthalate	X					X												
77-78-1	Dimethyl sulfate	X																	
25154-54-5	Dinitrobenzene										X								
534-52-1	4,6-Dinitro-o-cresol	X					X												
	Dinitrophenol										X								
51-28-5	2,4-Dinitrophenol	X					X												
25321-14-6	Dinitrotoluene										X								
121-14-2	2,4-Dinitrotoluene	X					X							X					
606-20-2	2,6-Dinitrotoluene	X					X												
117-84-0	Di-n-octyl phthalate	X					X												
123-91-1	Dioxane		X																
123-91-1	1,4-Dioxane	X																	
828-00-2	Dioxin		X											X					
101-84-2	Diphenyl ether															X			
38622-18-3	Diphenylhydrazine																	X	
122-66-7	1,2-Diphenylhydrazine	X					X												
142-84-7	Dipropylamine	X																	
621-64-7	Di-n-propylnitrosamine	X																	
2764-72-9	Diquat										X								
	Dissolved Oxygen							X											
	Dissolved Solids							X											
298-04-4	Disulfoton										X								
541-53-7	2,4-Dithiobiuret	X									–								
330-54-1	Diuron										X								
27176-87-0	Dodecylbenzenesulfonic acid										X								
60-00-4	EDTA										X								
115-29-7	Endosulfan	X									X								
959-98-8	Endosulfan-Alpha						X												
33213-65-9	Endosulfan-Beta						X												
1031-07-8	Endosulfan sulfate						X												
72-20-8	Endrin	X					X		X		X	X							
7421-93-4	Endrin aldehyde						X												

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106-89-8	Epichlorohydrin		X								X								
136-25-4	Erbon														X				
563-12-2	Ethion										X								
141-78-6	Ethyl acetate	X																	
140-88-5	Ethyl acrylate	X																	
100-41-4	Ethylbenzene						X				X			X					
75-00-3	Ethyl chloride																	X	
107-12-0	Ethylcyanide	X																	
	Ethylene bisdithiocarbamate	X																	
various	EBDC's (ethylenebisdithiocarbamates)											X							
107-15-3	Ethylenediamine	X									X								
106-93-4	Ethylene dibromide (EDB)		X								X	X							
107-06-2	Ethylene dichloride		X								X								
151-56-4	Ethyleneimine	X																	
75-21-8	Ethylene oxide	X	X									X							
96-45-7	Ethylene thiourea	X																	
60-29-7	Ethyl ether	X																	
97-63-2	Ethyl methacrylate	X																	
62-50-0	Ethyl methanesulfonate	X																	
56-38-2	Ethyl parathion												X						
2104-64-5	EPN (ethyl p-nitrophenyl thionobenzenephosonate)											X							
	Fecal coliform							X											
1185-57-5	Ferric ammonium citrate										X								
14221-47-7	Ferric ammonium oxalate										X								
7705-08-0	Ferric chloride										X								
	Ferric cyanide	X																	
7783-50-8	Ferric fluoride										X								
10421-48-4	Ferric nitrate										X								
10028-22-5	Ferric sulfate										X								
10045-89-3	Ferrous ammonium sulfate										X								
7758-94-3	Ferrous chloride										X								
7720-78-7	Ferrous sulfate										X								
206-44-0	Fluoranthene	X					X												
86-73-7	Fluorene						X												
	Fluorides															X			X
7782-41-4	Fluorine	X																	
640-19-7	2-Fluoroacetamide (1081)	X										X							
	Fluoroacetic acid, sodium salt	X																	
75-69-4	Fluorotrichloromethane	X																	
50-00-0	Formaldehyde	X	X								X			X					
64-18-6	Formic acid	X									X								
110-17-8	Fumaric acid										X								
110-00-9	Furan	X																	
98-01-1	Furfural	X									X								
	Glycidylaldehyde	X																	
	Gross alpha								X										
86-50-0	Guthion										X					X			
76-44-8	Heptachlor	X					X				X	X							
1024-57-3	Heptachlor epoxide						X												
118-74-1	Hexachlorobenzene	X					X							X					

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87-68-3	Hexachlorobutadiene	X					X							X					
58-89-9	Hexachlorocyclohexane	X																	
77-47-4	Hexachlorocyclopentadiene	X	X				X				X			X					
67-72-1	Hexachloroethane	X					X							X					
	1,2,3,4,10,10-Hexachloro-1,4,4a,5,8,8a-hexahydro-1,4:5,8-endo, endo-dimethanonaphthalene	X																	
70-30-4	Hexachlorophene	X																	
1888-71-7	Hexachloropropene	X																	
757-58-4	Hexaethyl tetraphosphate	X																	
302-01-2	Hydrazine	X																	
	Hydrocarbons				X														
7647-01-0	Hydrochloric acid										X								
74-90-8	Hydrocyanic acid	X																	
7664-39-3	Hydrofluoric acid	X									X								
74-90-8	Hydrogen cyanide										X								
7783-06-4	Hydrogen sulfide	X									X								
75-60-5	Hydroxydimethyl arsine oxide	X																	
193-39-5	Indeno (1,2,3-cd)pyrene	X					X												
15046-84-1	Iodine 129					X													
10043-66-0	Iodine 131					X													
74-88-4	Iodomethane	X																	
7439-89-6	Iron															X	X		
9004-66-4	Iron dextran	X																	
78-83-1	Isobutyl alcohol	X																	
624-83-9	Isocyanic acid, methyl ester	X																	
78-59-1	Isophorone						X							X					
78-79-5	Isoprene										X								
54590-52-2	Isopropanolamine Dodecylbenzene Sulfonate										X								
120-58-1	Isosafrole	X																	
115-32-2	Kelthane										X								
143-50-0	Kepone	X									X	X				X			
13983-27-2	Krypton 85					X													
303-34-4	Lasiocarpine	X																	
7439-92-1	Lead				X		X		X					X			X		
301-04-2	Lead acetate	X									X								
3687-31-8	Lead arsenate										X								
7758-95-4	Lead chloride										X								
13814-96-5	Lead fluoborate										X								
7783-46-2	Lead fluoride										X								
10101-63-0	Lead iodide										X								
10099-74-8	Lead nitrate										X								
7446-27-7	Lead phosphate	X																	
1072-35-1	Lead stearate										X								
1335-32-6	Lead subacetate	X																	
7446-14-2	Lead sulfate										X								
1314-87-0	Lead sulfide										X								
592-87-0	Lead thiocyanate										X								
58-89-9	Lindane								X		X	X							
14307-35-8	Lithium chromate										X								

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	Oleyl alcohol condensed with 2 moles ethylene oxide	X																	
20816-12-0	Osmium tetroxide	X																	
145-73-3	7-Oxabicycol(2.2.1)heptane-2,3-dicarboxylic acid	X																	
	Oxygen demand							X											
10028-15-6	Ozone				X														
30525-89-4	Paraformaldehyde										X								
123-63-7	Paraldehyde	X																	
4685-14-7	Paraquat														X				
56-38-2	Parathion	X									X					X			
608-93-5	Pentachlorobenzene	X																	
76-01-7	Pentachloroethane	X																	
82-68-8	Pentachloronitrobenzene (PCNB)	X										X							
87-86-5	Pentachlorophenol	X					X				X	X							
504-60-9	1,3-Pentadiene	X																	
127-18-4	Perchloroethylene		X																
72-56-0	Perthane														X				
	pH							X											
62-44-2	Phenacetin	X																	
85-01-8	Phenanthrene						X												
578-94-9	Phenarsazine chloride											X							
108-95-2	Phenol	X	X				X				X								
103-82-2	Phenylacetic acid																	X	
696-28-6	Phenyl dichloroarsine	X																	
62-38-4	Phenylmercury acetate	X																	
103-85-5	N-Phenylthiourea	X																	
298-02-2	Phorate	X																X	
75-44-5	Phosgene	X	X								X			X					
7803-51-2	Phosphine	X																	
7664-38-2	Phosphoric acid										X								
	Phosophorothioic acid, O,O-dimethyl ester, O-ester with N,N-dimethyl benzene sulfonamide	X																	
7723-14-0	Phosphorus							X			X					X			
10025-87-3	Phosphorus oxychloride										X								
1314-80-3	Phosphorus pentasulfide										X								
1314-80-3	Phosphorus sulfide	X																	
7719-12-2	Phosphorus trichloride										X								
	Photon emitters								X										
88-99-3	Phthalic acid																	X	
85-44-9	Phthalic anhydride	X																	
109-06-8	2-Picoline	X																	
51-03-6	Piperonyl butoxide														X				
13981-16-3	Plutonium 238					X													
15117-48-3	Plutonium 239					X													
various	Polybrominated biphenyls (PBBs)													X		X			
various	Polychlorinated biphenyls (PCBs)		X								X		X	X					
12674-11-2	PCB-1016 (Arochlor 1016)						X												
11104-28-2	PCB-1221 (Arochlor 1221)						X												
11141-16-5	PCB-1232 (Arochlor 1232)						X												

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53469-21-9	PCB-1242 (Arochlor 1242)						X												
12672-29-6	PCB-1248 (Arochlor 1248)						X												
11097-69-1	PCB-1254 (Arochlor 1254)						X												
11096-82-5	PCB-1260 (Arochlor 1260)						X												
7440-09-7	Potassium					X													
7784-41-0	Potassium arsenate										X								
10124-50-2	Potassium arsenite										X								
7778-50-9	Potassium bichromate										X								
7789-00-6	Potassium chromate										X								
151-50-8	Potassium cyanide	X									X								
1310-58-3	Potassium hydroxide										X								
7722-64-7	Potassium permanganate										X								
506-61-6	Potassium silver cyanide	X																	
23950-58-5	Pronamide	X										X							
1918-16-7	Propachlor																	X	
57-55-6	1,2-Propanediol	X																	
1120-71-4	1,3-Propane sultone	X																	
709-98-8	Propanil																	X	
2312-35-8	Propargite										X								
139-40-2	Propazine																	X	
79-09-4	Propionic acid										X								
123-62-6	Propionic anhydride										X								
107-12-0	Propionitrile	X																	
75-56-9	Proplyene oxide		X																
114-26-1	Propoxur												X						
107-10-8	n-Propylamine	X																	
107-19-7	2-Propyn-1-01	X																	
129-00-0	Pyrene						X												
121-29-9	Pyrethrin										X								
110-86-1	Pyridine	X																	
91-22-5	Quinoline										X								
	Quinones	X																	
	Radiokrypton					X													
	Radioxenon					X													
13982-63-3	Radium 226					X			X										
15262-20-1	Radium 228								X										
10043-92-2	Radon									X									
50-55-5	Reserpine	X																	
108-46-3	Resorcinol	X									X								
299-84-3	Ronnel														X				
83-79-4	Rotenone														X				
81-07-2	Saccharin	X																	
94-59-7	Safrole	X										X							
	Secondary amines															X			
7783-00-8	Selenious acid	X																	
7782-49-2	Selenium						X		X								X		
12640-89-0	Selenium oxide										X								
7446-34-6	Selenium sulfide	X																	
630-10-4	Selenourea	X																	
7440-22-4	Silver						X		X										
506-64-9	Silver cyanide	X																	

CHEMICAL ABSTRACT NUMBER	CHEMICAL	RCRA Hazardous Wastes	43 Air Priority Pollutants	5 NESHAPS Standards	7 NAAQS Criteria Pollutants	18 Radioactive Pollutants	129 Water Priority Pollutants	11 Conventional Water Pollutants	21 Drinking Water Standards	9 Potential DW Standards	299 Section 311 Hazardous	48 RPARS & Cancelled Pesticides	9 Monitored Pesticides	54 TSCA Assessment & Section 4	16 Pre-RPAR Review	41 Potential Water Criteria	15 Metals	29 Drinking Water Monitoring	3 Section 111D Air Pollutants
7761-88-8	Silver nitrate										X								
122-34-9	Simazine																	X	
7440-23-5	Sodium										X					X			
7631-89-2	Sodium arsenate										X	X							
7784-46-5	Sodium arsenite										X	X							
26628-22-8	Sodium azide	X																	
10588-01-9	Sodium bichromate										X								
1333-83-1	Sodium bifluoride										X								
7631-90-5	Sodium bisulfite										X								
7775-11-3	Sodium chromate										X								
143-33-9	Sodium cyanide	X									X								
25155-30-0	Sodium dodecylbenzenesulfonate										X								
7681-49-4	Sodium fluoride										X								
62-74-8	Sodium fluoroacetate (1080)											X							
16721-80-5	Sodium hydrosulfide										X								
1310-73-2	Sodium hydroxide										X								
7681-52-9	Sodium hypochlorite										X								
124-41-4	Sodium methylate										X								
7632-00-0	Sodium nitrite										X								
7558-79-4	Sodium phosphate, dibasic										X								
7601-54-9	Sodium phosphate, tribasic										X								
10102-18-8	Sodium selenite										X								
18883-66-4	Streptozotocin	X																	
8001-50-1	Strobane											X							
14158-27-1	Strontium 89					X													
10098-97-2	Strontium 90					X													
7789-06-2	Strontium chromate										X								
1314-96-1	Strontium sulfide	X																	
57-24-9	Strychnine	X									X	X							
100-42-5	Styrene										X					X			
	Sulfates															X			
	Sulfides															X			
7446-09-5	Sulfur dioxide				X														
7664-93-9	Sulfuric acid										X								
10025-67-9	Sulfur monochloride										X								
	Suspended solids							X											
72-54-8	TDE										X								
-	Terpenes															X			
95-94-3	1,2,4,5-Tetrachlorobenzene	X																	
1764-01-6	2,4,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)						X												
79-34-5	1,1,2,2-Tetrachloroethane													X					
630-20-6	1,1,1,2-Tetrachloroethane	X																	
79-34-5	1,1,2,2-Tetrachloroethane	X					X												
127-18-4	Tetrachloroethene	X																	
127-18-4	Tetrachloroethylene						X			X									
56-23-5	Tetrachloromethane	X																	
58-90-2	2,3,4,6-Tetrachlorophenol	X																	
3689-24-5	Tetraethyl dithiopyrophosphate	X																	
78-00-2	Tetraethyl lead	X									X								

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107-49-3	Tetraethyl pyrophosphate	X									X								
109-99-9	Tetrahydrofuran	X																	
509-14-8	Tetranitromethane	X																	
1314-32-5	Thallic oxide	X																	
7440-28-0	Thallium						X												
563-68-8	Thallium acetate	X																	
29809-42-5	Thallium carbonate	X																	
7791-12-0	Thallium chloride	X																	
10102-45-1	Thallium nitrate	X																	
	Thallium selenite	X																	
7446-18-6	Thallium sulfate	X									X								
62-55-5	Thioacetamide	X																	
23564-05-8	Thiophanate methyl											X							
79-19-6	Thiosemicarbazide	X																	
62-56-6	Thiourea	X																	
137-26-8	Thiuram	X																	
7440-32-6	Titanium																X		
108-88-3	Toluene	X	X				X				X			X					
25376-45-8	Toluenediamine	X																	
26471-62-5	Toluene diisocyanate	X																	
636-21-5	o-Toluidine hydrochloride	X																	
	Total reduced sulphur																		X
	Total suspended particulates				X														
8001-35-2	Toxaphene	X					X		X		X	X							
2303-17-5	Triallate														X				
75-25-2	Tribromomethane	X					X												
78-48-8	S,S,S-Tributyl phosphorotrithioate														X				
52-68-6	Trichlorfon										X				X				
120-82-1	1,2,4-Trichlorobenzene						X												
120-82-1	1,3,4-Trichlorobenzene																		
25323-89-1	Trichloroethane													X				X	
71-55-6	1,1,1-Trichloroethane	X					X			X				X					
79-00-5	1,1,2-Trichloroethane						X											X	
79-01-6	Trichloroethene	X																	
79-01-6	1,1,2-Trichloroethene													X					
79-01-6	Trichloroethylene		X				X			X	X								
75-69-4	Trichlorofluoromethane	X					X												
75-70-7	Trichloromethanethiol	X																	
25167-82-2	Trichlorophenol (TCP)										X								
95-95-4	2,4,5-Trichlorophenol	X										X							
88-06-2	2,4,6-Trichlorophenol	X					X												
93-76-5	2,4,5-Trichlorophenoxyacetic acid (T)	X									X	X							
various	2,4,5-T amines										X								
various	2,4,5-T esters										X								
various	2,4,5-T salts										X								
93-72-1	2,4,5-Trichlorophenoxypropionic acid (TP)	X									X					X			
various	2,4,5-TP acid esters										X								
27323-41-7	Triethanolamine dodecylbenzenesulfonate										X								
121-44-8	Triethylamine										X								

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	1582-09-8	Trifluraline (treflan)											X							
	75-50-3	Trimethylamine										X								
	99-35-4	Trinitrobenzene	X																	
	78-48-8	Triputyl phosophorotrithioate														X				
	126-72-7	Tris(2,3-dibromopropyl)phosphate	X																	
	10028-17-8	Tritium					X													
	72-57-1	Trypan blue	X																	
	50-31-7	Trysben											X							
		Turbidity								X										
	66-75-1	Uracil mustard	X																	
	7440-61-1	Uranium									X						X			
	13966-29-5	Uranium 234					X													
	15117-96-1	Uranium 235					X													
	7440-61-1	Uranium 238					X													
	541-09-3	Uranyl acetate										X								
	10102-06-4	Uranyl nitrate										X								
	51-79-6	Urethane	X																	
	11115-67-6	Vanadic acid, ammonium salt	X																	
—	7440-62-2	Vanadium															X	X		
	1314-62-1	Vanadium pentoxide	X									X								
	27774-13-6	Vanadyl sulfate										X								
	108-05-4	Vinyl acetate										X								
	75-01-4	Vinyl chloride			X			X			X									
	75-35-4	Vinylidene chloride		X								X			X					
	1330-20-7	Xylene	X									X								
	95-47-6	o-Xylene		X											X					
	108-38-3	m-Xylene		X											X					
	106-42-3	p-Xylene		X											X					
	1300-71-6	Xylenol										X								
	7440-66-6	Zinc						X												
	557-34-6	Zinc acetate										X								
		Zinc ammonium chloride										X								
	1332-07-6	Zinc borate										X								
	7699-45-8	Zinc bromide										X								
	3486-35-9	Zinc carbonate										X								
	7646-85-7	Zinc chloride										X								
	557-21-1	Zinc cyanide	X									X								
	7783-49-5	Zinc fluoride										X								
	557-41-5	Zinc formate										X								
	7779-86-4	Zinc hydrosulfite										X								
	7779-88-6	Zinc nitrate										X								
	127-82-2	Zinc phenol sulfonate										X								
	1314-84-7	Zinc phosphide	X									X								
	16871-71-9	Zinc silicofluoride										X								
	7733-02-0	Zinc sulfate										X								
	13746-89-9	Zirconium nitrate										X								
	16923-95-8	Zirconium potassium fluoride										X								
	14644-61-2	Zirconium sulfate										X								
	10026-11-6	Zirconium tetrachloride										X								

Table B-1 (continued)

☐ **43 PRIORITY CHEMICALS UNDER ASSESSMENT UNDER SECTION 112 CAA**

☐ Acetaldehyde
☐ Acrolein
☐ Acrylonitrile
☐ Allyl Chloride
☐ Benzyl Chloride
☐ Bis (Chloromethyl)Ether
☐ Carbon Tetrachloride
☐ Chlorobenzene
☐ Chloroform
☐ Chloroprene
☐ o-,m-,p- Cresol
☐ p-Dichlorobenzene
☐ Dimethyl Nitrosamine
☐ Dioxane
☐ Dioxin
☐ Epichlorohydrin
☐ Ethylene Dibromide
☐ Ethylene Dichloride
☐ Ethylene Oxide
☐ Formaldehyde
☐ Hexachlorocyclopentadiene
☐ Maleic Anhydride
☐ Manganese
☐ Methyl Chloroform
☐ Methylene Chloride (Dichloromethane)
☐ Methyl Iodide
☐ Nickel
☐ Nitrobenzene
☐ 2-Nitropropane
☐ N-Nitrosodiethylamine
☐ Nitrosomethylurea
☐ Nitrosomorpholine
☐ Perchloroethylene
☐ Phenol
☐ Phosgene
☐ Polychlorinated Biphenyls
☐ Proplyene Oxide
☐ Toluene
☐ Trichloroethylene
☐ Vinylidene Chloride
☐ o-,m-,p-Xylene

☐ **5 NESHAPS STANDARDS POLLUTANTS:**

☐ Asbestos
☐ Benzene
☐ Beryllium
☐ Mercury
☐ Vinyl Chloride

☐ **7 NATIONAL AMBIENT AIR QUALITY STANDARDS (NAAQS) POLLUTANTS:**

☐ Carbon Monoxide
☐ Hydrocarbons
☐ Lead
☐ Nitrogen Dioxide
☐ Ozone
☐ Sulfur Dioxide
☐ Total Suspended Particulate

☐ **3 POLLUTANTS REGULATED UNDER SECTION 111D CAA**

☐ Acid Mist
☐ Fluorides
☐ Total Reduced Sulphur

☐ 18 RADIOACTIVE POLLUTANTS

- ☐ Barium 140
- ☐ Carbon 14
- ☐ Cesium 137
- ☐ Iodine 129 and 131
- ☐ Krypton 85
- ☐ Plutonium 238 and 239
- ☐ Potassium
- ☐ Radiokrypton
- ☐ Radioxenon
- ☐ Radium 226
- ☐ Strontium 89 and 90
- ☐ Tritium
- ☐ Uranium 234, 235, and 238

☐ 129 CONSENT DECREE PRIORITY POLLUTANTS

- ☐ Acenaphthene
- ☐ Acenaphthylene
- ☐ Acrolein
- ☐ Acrylonitrile
- ☐ Aldrin
- ☐ Anthracene
- ☐ Antimony
- ☐ Arsenic
- ☐ Asbestos
- ☐ BHC-Alpha
- ☐ BHC-Beta
- ☐ BHC (lindane)-Gamma
- ☐ BHC-Delta
- ☐ Benzene
- ☐ Benzidine
- ☐ Benzo(a)anthracene (1,2-benzarthracene)
- ☐ 3,4-Benzofluoranthene (benzo(b)fluoranthene)
- ☐ Benzo(k)fluoranthene
- ☐ Benzo(g,h,i)perylene (1,12-benzoperylene)
- ☐ Benzo[a]pyrene (3,4-benzopyrene)
- ☐ Beryllium
- ☐ Bis(2-chloroethoxy)methane
- ☐ Bis(2-chloroethyl)ether
- ☐ Bis(2-chloroisopropyl)ether
- ☐ Bis(chloromethyl)ether
- ☐ Bis(2-ethylhexyl)phthalate
- ☐ Bromoform (tribromomethane)
- ☐ 4-Bromophenyl phenyl ether
- ☐ Butyl benzyl phthalate
- ☐ Cadmium
- ☐ Carbon tetrachloride
- ☐ Chlordane
- ☐ Chlorobenzene
- ☐ Chlorodibromomethane
- ☐ Chloroethane
- ☐ 2-Chloroethylvinyl ether
- ☐ Chloroform (trichloromethane)
- ☐ p-Chloro-m-cresol
- ☐ 2-Chloronaphthalene
- ☐ 2-Chlorophenol
- ☐ Chromium
- ☐ 4-Chlorophenyl phenyl ether
- ☐ Chrysene
- ☐ Copper
- ☐ Cyanide
- ☐ 4,4'-DDD(p,p'-TDE)
- ☐ 4,4'-DDE(p,p'-DDX)
- ☐ 4,4'-DDT
- ☐ Dibenzo[a,h]anthracene
- ☐ Di-n-butyl phthalate
- ☐ 1,2-Dichlorobenzene
- ☐ 1,3-Dichlorobenzene
- ☐ 1,4-Dichlorobenzene
- ☐ 3,3'-Dichlorobenzidine
- ☐ Dichlorobromomethane
- ☐ Dichlorodifluoromethane
- ☐ 1,1-Dichloroethane
- ☐ 1,2-Dichloroethane
- ☐ 1,1-Dichloroethylene
- ☐ 1,2-trans-Dichloroethylene
- ☐ 2,4-Dichlorophenol
- ☐ 1,2-Dichloropropane
- ☐ 1,2-Dichloropropylene (1,3-dichloropropane)
- ☐ Dieldrin
- ☐ Diethyl phthalate
- ☐ 2,4-Dimethylphenol
- ☐ Dimethyl phthalate
- ☐ 4,6-Dinitro-o-cresol
- ☐ 2,4-Dinitrophenol
- ☐ 2,4-Dinitrotoluene
- ☐ 2,6-Dinitrotoluene
- ☐ Di-n-octyl phthalate
- ☐ 1,2-Diphenylhydrazine
- ☐ Endosulfan-Alpha
- ☐ Endosulfan-Beta
- ☐ Endosulfan sulfate
- ☐ Endrin
- ☐ Endrin aldehyde
- ☐ Ethylbenzene

☐ Fluoranthene
☐ Fluorene
☐ Heptachlor
☐ Heptachlor epoxide
☐ Hexachlorobenzene
☐ Hexachlorobutadiene
☐ Hexachlorocyclopentadiene
☐ Hexachloroethane
☐ Indeno (1,2,3-cd)pyrene
☐ Isophorone
☐ Lead
☐ Mercury
☐ Methyl bromide
(bromomethane)
☐ Methyl chloride
(chloromethane)
☐ Methylene chloride
(dichloromethane)
☐ Naphthalene
☐ Nickel
☐ Nitrobenzene
☐ 2-Nitrophenol
☐ 4-Nitrophenol
☐ N-Nitrosodimethylamine
☐ N-Nitrosodiphenylamine
☐ N-Nitrosodi-n-propylamine
☐ Pentachlorophenol
☐ Phenanthrene
☐ Phenol
☐ PCB-1016 (Arochlor 1016)
☐ PCB-1221 (Arochlor 1221)
☐ PCB-1232 (Arochlor 1232)
☐ PCB-1242 (Arochlor 1242)
☐ PCB-1248 (Arochlor 1248)
☐ PCB-1254 (Arochlor 1254)
☐ PCB-1260 (Arochlor 1260)
☐ Pyrene
☐ Selenium
☐ Silver
☐ 2,4,7,8-Tetrachlorodibenzo-
p-dioxin (TCDD)
☐ 1,1,2,2-Tetrachloroethane
☐ Tetrachloroethylene
☐ Thallium
☐ Toulene
☐ Toxaphene
☐ 1,2,4-Trichlorobenzene
☐ 1,1,1-Trichloroethane
☐ 1,1,2-Trichloroethane
☐ Trichloroethylene
☐ Trichlorofluoromethane
☐ 2,4,6-Trichlorophenol
☐ Vinyl chloride
☐ Zinc

☐ 11 "CONVENTIONAL" WATER POLLUTANTS

☐ Acidity
☐ Alkalinity
☐ Dissolved Oxygen
☐ Dissolved Solids
☐ Fecal Coliform
☐ Nitrogen and Compounds
☐ Oil & Grease
☐ Oxygen Demand
☐ pH
☐ Phosphorus and Compounds
☐ Suspended Solids

☐ 41 POLLUTANTS BEING CONSIDERED FOR PUBLICATION OF ADDITIONAL CRITERIA UNDER CWA

- ☐ Acetone
- ☐ n-Alkanes (c_{10} - c_{30})
- ☐ Aluminum and Compounds
- ☐ Ammonia
- ☐ Barium and Compounds
- ☐ Biphenyl
- ☐ Bismuth and Compounds
- ☐ Boron and Compounds
- ☐ Bromine
- ☐ Chlorine
- ☐ Cobalt
- ☐ 2,4-D
- ☐ Demeton
- ☐ Dialkyl ethers
- ☐ Dibenzofuran
- ☐ Diphenyl ether
- ☐ Fluorides
- ☐ Guthion
- ☐ Iron and Compounds
- ☐ Kepone
- ☐ Lithium and Compounds
- ☐ Malathion
- ☐ Manganese and Compounds
- ☐ Methoxychlor
- ☐ Methylethyl ketone
- ☐ Mirex
- ☐ Molybdenum and Compounds
- ☐ Nitrates/Nitrites
- ☐ Nitriloacetates
- ☐ Parathion
- ☐ Phosphorus and Compounds
- ☐ Polybrominated biphenyls
- ☐ Secondary amines
- ☐ Sodium and Compounds
- ☐ Styrene
- ☐ Sulfates
- ☐ Sulfides
- ☐ 2,4,5-TP
- ☐ Terpenes
- ☐ Uranium
- ☐ Vanadium

☐ CONSTITUENTS REGULATED IN DRINKING WATER UNDER SDWA - NATIONAL INTERIM PRIMARY DW REGULATIONS

- ☐ Arsenic
- ☐ Barium
- ☐ Cadmium
- ☐ Chromium
- ☐ 2,4-D
- ☐ Endrin
- ☐ Gross Alpha
- ☐ Lead
- ☐ Lindane
- ☐ Manmade Beta
- ☐ Mercury

Also:
- Fluoride
- Chloroform
- Bromodichloromethane
- Other Trihalomethanes

- ☐ Methoxychlor
- ☐ Microbiology-coliform bacteria
- ☐ Nitrate
- ☐ Photon emitters
- ☐ Radium 226 and 228
- ☐ Selenium
- ☐ Silver
- ☐ Silvex
- ☐ Toxaphene
- ☐ Turbidity

☐ 9 CONSTITUENTS UNDER CONSIDERATION FOR REGULATION UNDER REVISED NATIONAL PRIMARY DRINKING WATER REGULATIONS

- ☐ Carbon tetrachloride
- ☐ 1,2-Dichloroethane
- ☐ Mono- and Dichlorobenzenes
- ☐ Radon
- ☐ Tetrachloroethylene
- ☐ 1,1,1-Trichloroethane
- ☐ Trichloroethylene
- ☐ Uranium
- ☐ Vinyl chloride

☐ 29 ADDITIONAL COMPOUNDS SURVEYED IN DRINKING WATER

- ☐ Alachlor
- ☐ Atrazine
- ☐ Banvel-D
- ☐ Benefin
- ☐ Bromobenzene
- ☐ Bromochlorobenzene
- ☐ Bromodichloromethane
- ☐ Butachlor
- ☐ Chlorodibromomethane
- ☐ Cyanazine
- ☐ Dibutylphthalate
- ☐ Dichloroiodomethane
- ☐ cis-1,2-Dichloroethylene
- ☐ trans-1,2-Dichloroethylene
- ☐ Diethylphthalate
- ☐ Diphenylhydrazine
- ☐ Ethylchloride
- ☐ O-Methoxyphenol
- ☐ Nitralin
- ☐ Phenylacetic Acid
- ☐ Phorate
- ☐ Phthalic Acid
- ☐ Propachlor
- ☐ Propanil
- ☐ Propazine
- ☐ Simazine
- ☐ 1,1,1,2-Tetrachloroethane
- ☐ 1,3,4-Trichlorobenzene
- ☐ 1,1,2-Trichloroethane

☐ 299 HAZARDOUS SUBSTANCES REGULATED UNDER SECTION 311 OF THE WATER POLLUTION CONTROL ACT

- ☐ Acetaldehyde
- ☐ Acetic acid
- ☐ Acetic anhydride
- ☐ Acetone cyanohydrin
- ☐ Acetyl bromide
- ☐ Acetyl chloride
- ☐ Acrolein
- ☐ Acrylonitrile
- ☐ Adipic acid
- ☐ Aldrin
- ☐ Allyl alcohol
- ☐ Allyl chloride
- ☐ Aluminum sulfate
- ☐ Ammonia
- ☐ Ammonium acetate
- ☐ Ammonium benzoate
- ☐ Ammonium bicarbonate
- ☐ Ammonium bichromate
- ☐ Ammonium bifluoride
- ☐ Ammonium bisulfite
- ☐ Ammonium carbamate
- ☐ Ammonium carbonate
- ☐ Ammonium chloride
- ☐ Ammonium chromate
- ☐ Ammonium citrate
- ☐ Ammonium fluoborate
- ☐ Ammonium fluoride
- ☐ Ammonium hydroxide
- ☐ Ammonium oxalate
- ☐ Ammonium silicofluoride
- ☐ Ammonium sulfamate
- ☐ Ammonium sulfide
- ☐ Ammonium sulfite
- ☐ Ammonium tartrate
- ☐ Ammonium thiocyanate
- ☐ Ammonium thiosulfate
- ☐ Amyl acetate
- ☐ Aniline
- ☐ Antimony pentachloride
- ☐ Antimony potassium tartrate
- ☐ Antimony tribromide
- ☐ Antimony trichloride
- ☐ Antimony trifluoride
- ☐ Antimony trioxide
- ☐ Arsenic disulfide
- ☐ Arsenic pentoxide
- ☐ Arsenic trichloride
- ☐ Arsenic trioxide
- ☐ Arsenic trisulfide
- ☐ Barium cyanide
- ☐ Benzene
- ☐ Benzoic acid
- ☐ Benzonitrile
- ☐ Benzoyl chloride
- ☐ Benzyl chloride
- ☐ Beryllium chloride
- ☐ Beryllium fluoride
- ☐ Beryllium nitrate
- ☐ Butyl acetate
- ☐ n-Butyl phthalate
- ☐ Butylamine
- ☐ Butyric acid
- ☐ Cadmium acetate
- ☐ Cadmium bromide

☐ Cadmium chloride
☐ Calcium arsenate
☐ Calcium arsenite
☐ Calcium carbide
☐ Calcium chromate
☐ Calcium cyanide
☐ Calcium dodecylbenzenesulfonate
☐ Calcium hydroxide
☐ Calcium hypochlorite
☐ Calcium oxide
☐ Captan
☐ Carbaryl
☐ Carbofuran
☐ Carbon disulfide
☐ Carbon tetrachloride
☐ Chlordane
☐ Chlorine
☐ Chlorobenzene
☐ Chloroform
☐ Chlorpyrifos
☐ Chlorosulfonic acid
☐ Chromic acetate
☐ Chromic acid
☐ Chromic sulfate
☐ Chromous chloride
☐ Cobaltous bromide
☐ Cobaltous formate
☐ Cobaltous sulfamate
☐ Coumaphos
☐ Cresol
☐ Crotonal dehyde
☐ Cupric acetate
☐ Cupric acetoarsenite
☐ Cupric chloride
☐ Cupric nitrate
☐ Cupric oxalate
☐ Cupric sulfate
☐ Cupric sulfate ammoniated
☐ Cupric tartrate
☐ Cyanogen chloride
☐ Cyclohexane
☐ 2,4-D Acid
☐ 2,4-D Esters
☐ DDT
☐ Diazinon
☐ Dicamba
☐ Dichlobenil
☐ Dichlone
☐ Dichlorobenzene
☐ Dichloropropane
☐ Dichloropropene
☐ Dichloropropene-Dichloropropane Mixture
☐ 2,2-Dichloropropionic acid
☐ Dichlorvos
☐ Dieldrin
☐ Diethylamine
☐ Dimethylamine
☐ Dinitrobenzene
☐ Dinitrophenol
☐ Dinitrotoluene
☐ Diquat
☐ Disulfoton
☐ Diuron
☐ Dodecylbenzenesulfonic acid
☐ Endosulfan
☐ Endrin
☐ Epichlorohydrin
☐ Ethion
☐ Ethylbenzene
☐ Ethylenediamine
☐ Ethylene dibromide
☐ Ethylene dichloride
☐ EDTA
☐ Ferric ammonium citrate
☐ Ferric ammonium oxalate
☐ Ferric chloride
☐ Ferric fluoride
☐ Ferric nitrate
☐ Ferric sulfate
☐ Ferrous ammonium sulfate
☐ Ferrous chloride
☐ Ferrous sulfate
☐ Formaldehyde
☐ Formic acid
☐ Fumaric acid
☐ Furfural
☐ Guthion
☐ Heptachlor
☐ Hexachlorocyclopentadiene
☐ Hydrochloric acid
☐ Hydrofluoric acid
☐ Hydrogen cyanide
☐ Hydrogen sulfide
☐ Isoprene
☐ Isopropanolamine dodecylbenzenesulfonate
☐ Kelthane
☐ Kepone
☐ Lead acetate
☐ Lead arsenate
☐ Lead chloride
☐ Lead fluorborate
☐ Lead fluoride
☐ Lead iodide
☐ Lead nitrate

- ☐ Lead stearate
- ☐ Lead sulfate
- ☐ Lead sulfide
- ☐ Lead thiocyanate
- ☐ Lindane
- ☐ Lithium chromate
- ☐ Malathion
- ☐ Maleic acid
- ☐ Maleic anhydride
- ☐ Mercaptodimethur
- ☐ Mercuric cyanide
- ☐ Mercuric nitrate
- ☐ Mercuric sulfate
- ☐ Mercuric thiocyanate
- ☐ Mercurous nitrate
- ☐ Methoxychlor
- ☐ Methyl mercaptan
- ☐ Methyl methacrylate
- ☐ Methyl parathion
- ☐ Mevinphos
- ☐ Mexacarbate
- ☐ Monoethylamine
- ☐ Monomethylamine
- ☐ Naled
- ☐ Naphthalene
- ☐ Naphthenic acid
- ☐ Nickel ammonium sulfate
- ☐ Nickel chloride
- ☐ Nickel hydroxide
- ☐ Nickel nitrate
- ☐ Nickel sulfate
- ☐ Nitric acid
- ☐ Nitrobenzene
- ☐ Nitrogen dioxide
- ☐ Nitrophenol
- ☐ Nitrotoluene
- ☐ Paraformaldehyde
- ☐ Parathion
- ☐ Pentachlorophenol
- ☐ Phenol
- ☐ Phosgene
- ☐ Phosphoric acid
- ☐ Phosphorus
- ☐ Phosphorus oxychloride
- ☐ Phosphorus pentasulfide
- ☐ Phosphorus trichloride
- ☐ Polychlorinated biphenyls
- ☐ Potassium arsenate
- ☐ Potassium arsenite
- ☐ Potassium bichromate
- ☐ Potassium chromate
- ☐ Potassium cyanide
- ☐ Potassium hydroxide
- ☐ Potassium permanganate
- ☐ Propargite
- ☐ Propionic acid
- ☐ Propionic anhydride
- ☐ Propylene oxide
- ☐ Pyrethrins
- ☐ Quinoline
- ☐ Resorcinal
- ☐ Selenium oxide
- ☐ Silver nitrate
- ☐ Sodium
- ☐ Sodium arsenate
- ☐ Sodium arsenite
- ☐ Sodium bichromate
- ☐ sodium bifluoride
- ☐ Sodium bisulfite
- ☐ Sodium chromate
- ☐ Sodium cyanide
- ☐ Sodium dodecylbenzenesulfonate
- ☐ Sodium fluoride
- ☐ Sodium hydrosulfide
- ☐ Sodium hydroxide
- ☐ Sodium hypochlorite
- ☐ Sodium methylate
- ☐ Sodium nitrite
- ☐ Sodium phosphate, dibasic
- ☐ Sodium phosphate, tribasic
- ☐ Sodium selenite
- ☐ Strontium chromate
- ☐ Strychnine
- ☐ Styrene
- ☐ Sulfuric acid
- ☐ Sulfur monochloride
- ☐ 2,4,5-T acid
- ☐ 2,4,5-T amines
- ☐ 2,4,5-T esters
- ☐ 2,4,5-T salts
- ☐ TDE
- ☐ Tetraethyl lead
- ☐ Tetraethyl pyrophosphate
- ☐ Thallium sulfate
- ☐ Toluene
- ☐ Toxaphene
- ☐ 2,4,5-TP acid
- ☐ 2,4,5-TP acid esters
- ☐ Trichlorfon
- ☐ Trichloroethylene
- ☐ Trichlorophenol
- ☐ Triethanolamine dodecylbenzenesulfonate
- ☐ Triethylamine
- ☐ Trimethylamine
- ☐ Uranyl acetate
- ☐ Uranyl nitrate

☐ Vanadium pentoxide
☐ Vanadyl sulfate
☐ Vinyl acetate
☐ Vinylidene chloride
☐ Xylene
☐ Xylenol
☐ Zinc acetate
☐ Zinc ammonium chloride
☐ Zinc borate
☐ Zinc bromide
☐ Zinc carbonate
☐ Zinc chloride
☐ Zinc cyanide
☐ Zinc fluoride
☐ Zinc formate
☐ Zinc hydrosulfite
☐ Zinc nitrate
☐ Zinc phenolsulfonate
☐ Zinc phosphide
☐ Zinc silicofluoride
☐ Zinc sulfate
☐ Zirconium nitrate
☐ Zirconium potassium fluoride
☐ Zirconium sulfate
☐ Zirconium tetrachloride

☐ 48 CANCELLED PESTICIDES AND RPAR CHEMICALS

☐ Acrylonitrile
☐ Aldrin
☐ Amitraz (Baam)
☐ Aramite
☐ Arsenic and compounds
☐ Benomyl
☐ Benzac
☐ Cadmium
☐ Chloranil
☐ Chlordane
☐ Chlordecone (kepone)
☐ Chlorobenzilate
☐ Chloroform (trichloromethane)
☐ Coal Tar
☐ Creosote
☐ DBCP (1,2-dibromo-3-chloropropane)
☐ DDD (TDE)
☐ DDT
☐ Diallate
☐ Dieldrin
☐ Dimethoate
☐ Endrin
☐ EBDC's (ethylenebisdithio-(carbamates)
☐ EPN (ethyl p-nitrophenyl thionobenzenephosonate)
☐ Ethylene dibromide (EDB)
☐ Ethylene oxide
☐ Heptachlor
☐ Lindane
☐ Maleic hydrazide
☐ Mirex
☐ Monuron
☐ OMPA (octamethylpyrophos-(phoramide)
☐ PCNB (pentachloronitrobenzene)
☐ Pentachlorophenol and derivative
☐ Phenarsazine chloride
☐ Pronamide
☐ Safrole
☐ Silvex
☐ Sodium fluoroacetate (1080)
☐ Stobane
☐ Strychnine
☐ Thiophanate methyl
☐ Toxaphene
☐ Trifluraline (treflan)
☐ Trysben
☐ 2,4,5-T
☐ 2,4,5-Trichlorophenol (TCP)
☐ 1081

☐ 9 ADDITIONAL PESTICIDE CHEMICALS MEASURED IN HUMAN MONITORING

☐ Carbofuran
☐ Chlorpyrifos
☐ Dialkyl phosphates
☐ 2,4-D
☐ Dicamba
☐ Malathion
☐ Methyl and ethyl parathion
☐ PCBs
☐ Propoxur

☐ 54 SELECTED CHEMICALS AND SUBSTANCES UNDER ASSESSMENT UNDER TOSCA, UNDER CONSIDERATION FOR SECTION 4 TEST RULE OR IDENTIFIED FOR REGULATION BY THE IRLG

Acetaldehyde
Acrolein
Acrylonitrile
Antimony
Arsenic and compounds
Asbestos
Benzene
Benzidine
Benzyl chloride
Cadmium
Chlorinated naphthalenes
Chlorofluorocarbons
Chloroprene
Chloroethane
Chloroform
Chloromethane
Chromium and compounds
Cresols (3)
Dichlorobenzenes (3)
Dichloroethanes
Dichloromethane
1,2 Dibromoethane
1,2 Dichloropropane
2,4 Dinitrotoluene
Dioxin
Ethylbenzene
Formaldehyde
Hexachlorobenzene (HCB)
Hexachlorobutadine
Hexachlorocyclopentadiene
Hexachloroethane
Isophorone
Lead
Maleic anhydride
Mercury and mercury compounds
Methyl iodide
Nitrobenzene
2-Nitropropane
PBBs
PCVBs
Phosgene
1,1,2,2-Tetrachloroethane
Toluene
1,1,1-Trichloroethane
1,1,2-Trichloroethane
Trichloroethane
Vinylidene chloride
Xylenes (3)

☐ 16 CHEMICALS PESTICIES UNDER PRE-RPAR REVIEW

☐ Cacodylic acid and salts
☐ Captan
☐ Carbaryl
☐ Carbon tetrachloride
☐ Dichlorvos (DDVP)
☐ Erbon
☐ Methanearsonates
☐ Paraquat
☐ Perthane
☐ Piperonyl butoxide
☐ Ronnel
☐ Rotenone
☐ S,S,S - tributyl phosphorotrithioate
☐ Triallate
☐ Trichlorofon
☐ Triputyl phosphorotrithioate

☐ 15 METALS OF INTEREST

☐ Arsenic
☐ Barium
☐ Beryllium
☐ Cadmium
☐ Chromium
☐ Cobalt
☐ Copper
☐ Iron
☐ Lead
☐ Manganese
☐ Mercury
☐ Nickel
☐ Sellenium
☐ Titanium
☐ Vanadium

Table B-2. Updated List of Chemicals Governed by RCRA

Appendix VIII—Hazardous Constituents

Acetaldehyde
(Acetato)phenylmercury
Acetonitrile
3-(alpha-Acetonylbenzyl)-4-hydroxycoumarin and salts
2-Acetylaminofluorene
Acetyl chloride
1-Acetyl-2-thiourea
Acrolein
Acrylamide
Acrylonitrile
Aflatoxins
Aldrin
Allyl alcohol
Aluminum phosphide
4-Aminobiphenyl
6-Amino-1,1a,2,8,8a,8b-hexahydro-8-(hydroxymethyl)-8a-methoxy-5-methylcarbamate azirino(2',3':3,4) pyrrolo(1,2-a)indole-4,7-dione (ester) (Mitomycin C)
5-(Aminomethyl)-3-isoxazolol
4-Aminopyridine
Amitrole
Antimony and compounds, N.O.S.
Aramite
Arsenic and compounds, N.O.S.
Arsenic acid
Arsenic pentoxide
Arsenic trioxide
Auramine
Azaserine
Barium and compounds, N.O.S.
Barium cyanide
Benz[c]acridine
Benz[a]anthracene
Benzene
Benzenearsonic acid
Benzenethiol
Benzidine
Benzo[a]anthracene
Benzo[b]fluoranthene
Benzo[j]fluoranthene
Benzo[a]pyrene
Benzotrichloride
Benzyl chloride
Beryllium and compounds, N.O.S.
Bis(2-chloroethoxy)methane
Bis(2-chloroethyl) ether
N,N-Bis(2-chloroethyl)-2-naphthylamine
Bis(2-chloroisopropyl) ether
Bis(chloromethyl) ether
Bis(2-ethylhexyl) phthalate
Bromoacetone
Bromomethane
4-Bromophenyl phenyl ether
Brucine
2-Butanone peroxide
Butyl benzyl phthalate
2-sec-Butyl-4,6-dinitrophenol (DNBP)
Cadmium and compounds, N.O.S.
Calcium chromate
Calcium cyanide
Carbon disulfide
Chlorambucil
Chlordane (alpha and gamma isomers)
Chlorinated benzenes, N.O.S.
Chlorinated ethane, N.O.S.
Chlorinated naphthalene, N.O.S.
Chlorinated phenol, N.O.S.
Chloroacetaldehyde
Chloroalkyl ethers
p-Chloroaniline
Chlorobenzene
Chlorobenzilate
1-(p-Chlorobenzoyl)-5-methoxy-2-methylindole-3-acetic acid
p-Chloro-m-cresol
1-Chloro-2,3-epoxybutane
2-Chloroethyl vinyl ether
Chloroform
Chloromethane
Chloromethyl methyl ether
2-Chloronaphthalene
2-Chlorophenol
1-(o-Chlorophenyl)thiourea
3-Chloropropionitrile
alpha-Chlorotoluene
Chlorotoluene, N.O.S.
Chromium and compounds, N.O.S.
Chrysene
Citrus red No. 2
Copper cyanide
Creosote
Crotonaldehyde
Cyanides (soluble salts and complexes), N.O.S.
Cyanogen
Cyanogen bromide
Cyanogen chloride
Cycasin
2-Cyclohexyl-4,6-dinitrophenol
Cyclophosphamide
Daunomycin
DDD
DDE
DDT
Diallate
Dibenz[a,h]acridine
Dibenz[a,j]acridine
Dibenz[a,h]anthracene(Dibenzo[a,h]anthracene)
7H-Dibenzo[c,g]carbazole
Dibenzo[a,e]pyrene
Dibenzo[a,h]pyrene
Dibenzo[a,i]pyrene
1,2-Dibromo-3-chloropropane
1,2-Dibromoethane
Dibromomethane
Di-n-butyl phthalate
Dichlorobenzene, N.O.S.
3,3'-Dichlorobenzidine
1,1-Dichloroethane
1,2-Dichloroethane
trans-1,2-Dichloroethane
Dichloroethylene, N.O.S.
1,1-Dichloroethylene
Dichloromethane
2,4-Dichlorophenol
2,6-Dichlorophenol
2,4-Dichlorophenoxyacetic acid (2,4-D)
Dichloropropane
Dichlorophenylarsine
1,2-Dichloropropane
Dichloropropanol, N.O.S.
Dichloropropene, N.O.S.
1,3-Dichloropropene
Dieldrin
Diepoxybutane
Diethylarsine
0,0-Diethyl-S-(2-ethylthio)ethyl ester of phosphorothioic acid
1,2-Diethylhydrazine
0,0-Diethyl-S-methylester phosphorodithioic acid
0,0-Diethylphosphoric acid, 0-p-nitrophenyl ester
Diethyl phthalate
0,0-Diethyl-0-(2-pyrazinyl)phosphorothioate
Diethylstilbestrol
Dihydrosafrole
3,4-Dihydroxy-alpha-(methylamino)-methyl benzyl alcohol
Di-isopropylfluorophosphate (DFP)
Dimethoate
3,3'-Dimethoxybenzidine
p-Dimethylaminoazobenzene
7,12-Dimethylbenz[a]anthracene
3,3'-Dimethylbenzidine
Dimethylcarbamoyl chloride
1,1-Dimethylhydrazine
1,2-Dimethylhydrazine
3,3-Dimethyl-1-(methylthio)-2-butanone-0-((methylamino) carbonyl)oxime
Dimethylnitrosamine
alpha,alpha-Dimethylphenethylamine
2,4-Dimethylphenol
Dimethyl phthalate
Dimethyl sulfate
Dinitrobenzene, N.O.S.
4,6 Dinitro-o-cresol and salts
2,4-Dinitrophenol
2,4-Dinitrotoluene
2,6 Dinitrotoluene Di-n-octyl phthalate
1,4-Dioxane
1,2-Diphenylhydrazine
Di-n-propylnitrosamine
Disulfoton
2,4-Dithiobiuret
Endosulfan
Endrin and metabolites
Epichlorohydrin
Ethyl cyanide
Ethylene diamine
Ethylenebisdithiocarbamate (EBDC)
Ethyleneimine
Ethylene oxide
Ethylenethiourea
Ethyl methanesulfonate
Fluoranthene
Fluorine
2-Fluoroacetamide
Fluoroacetic acid, sodium salt
Formaldehyde
Glycidylaldehyde
Halomethane, N.O.S.
Heptachlor
Heptachlor epoxide (alpha, beta, and gamma isomers)
Hexachlorobenzene
Hexachlorobutadiene
Hexachlorocyclohexane (all isomers)
Hexachlorocyclopentadiene
Hexachloroethane
1,2,3,4,10,10-Hexachloro-1,4,4a,5,8,8a-hexahydro-1,4:5,8-endo,endo-dimethanonaphthalene
Hexachlorophene
Hexachloropropene
Hexaethyl tetraphosphate
Hydrazine
Hydrocyanic acid
Hydrogen sulfide
Indeno(1,2,3-c,d)pyrene
Iodomethane
Isocyanic acid, methyl ester
Isosafrole
Kepone
Lasiocarpine
Lead and compounds, N.O.S.
Lead acetate
Lead phosphate
Lead subacetate

Table B-2. Updated List of Chemicals Governed by RCRA (continued)

Maleic anhydride
Malononitrile
Melphalan
Mercury and compounds, N.O.S.
Methapyrilene
Methomyl
2-Methylaziridine
3-Methylcholanthrene
4,4'-Methylene-bis-(2-chloroaniline)
Methyl ethyl ketone (MEK)
Methyl hydrazine
2-Methyllactonitrile
Methyl methacrylate
Methyl methanesulfonate
2-Methyl-2-(methylthio)propionaldehyde-o-(methylcarbonyl) oxime
N-Methyl-N'-nitro-N-nitrosoguanidine
Methyl parathion
Methylthiouracil
Mustard gas
Naphthalene
1,4-Naphthoquinone
1-Naphthylamine
2-Naphthylamine
1-Naphthyl-2-thiourea
Nickel and compounds, N.O.S.
Nickel carbonyl
Nickel cyanide
Nicotine and salts
Nitric oxide
p-Nitroaniline
Nitrobenzene
Nitrogen dioxide
Nitrogen mustard and hydrochloride salt
Nitrogen mustard N-oxide and hydrochloride salt
Nitrogen peroxide
Nitrogen tetroxide
Nitroglycerine
4-Nitrophenol
4-Nitroquinoline-1-oxide
Nitrosamine, N.O.S.
N-Nitrosodi-N-butylamine
N-Nitrosodiethanolamine
N-Nitrosodiethylamine
N-Nitrosodimethylamine
N-Nitrosodiphenylamine
N-Nitrosodi-N-propylamine
N-Nitroso-N-ethylurea
N-Nitrosomethylethylamine
N-Nitroso-N-methylurea
N-Nitroso-N-methylurethane
N-Nitrosomethylvinylamine
N-Nitrosomorpholine
N-Nitrosonornicotine
N-Nitrosopiperidine
N-Nitrosopyrrolidine
N-Nitrososarcosine
5-Nitro-o-toluidine
Octamethylpyrophosphoramide
Oleyl alcohol condensed with 2 moles ethylene oxide
Osmium tetroxide
7-Oxabicyclo[2.2.1]heptane-2,3-dicarboxylic acid
Parathion
Pentachlorobenzene
Pentachloroethane
Pentachloronitrobenzene (PCNB)
Pentacholorophenol
Phenacetin
Phenol
Phenyl dichloroarsine
Phenylmercury acetate
N-Phenylthiourea
Phosgene
Phosphine
Phosphorothioic acid, O,O-dimethyl ester, O-ester with N,N-dimethyl benzene sulfonamide
Phthalic acid esters, N.O.S.
Phthalic anhydride
Polychlorinated biphenyl, N.O.S.
Potassium cyanide
Potassium silver cyanide
Pronamide
1,2-Propanediol
1,3-Propane sultone
Propionitrile
Propylthiouracil
2-Propyn-1-ol
Pryidine
Reserpine
Saccharin
Safrole
Selenious acid
Selenium and compounds, N.O.S.
Selenium sulfide
Selenourea
Silver and compounds, N.O.S.
Silver cyanide
Sodium cyanide
Streptozotocin
Strontium sulfide
Strychnine and salts
1,2,4,5-Tetrachlorobenzene
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)
Tetrachloroethane, N.O.S.
1,1,1,2-Tetrachloroethane
1,1,2,2-Tetrachloroethane
Tetrachloroethene (Tetrachloroethylene)
Tetrachloromethane
2,3,4,6-Tetrachlorophenol
Tetraethyldithiopyrophosphate
Tetraethyl lead
Tetraethylpyrophosphate
Thallium and compounds, N.O.S.
Thallic oxide
Thallium (I) acetate
Thallium (I) carbonate
Thallium (I) chloride
Thallium (I) nitrate
Thallium selenite
Thallium (I) sulfate
Thioacetamide
Thiosemicarbazide
Thiourea
Thiuram
Toluene
Toluene diamine
o-Toluidine hydrochloride
Tolylene diisocyanate
Toxaphene
Tribromomethane
1,2,4-Trichlorobenzene
1,1,1-Trichloroethane
1,1,2-Trichloroethane
Trichloroethene (Trichloroethylene)
Trichloromethanethiol
2,4,5-Trichlorophenol
2,4,6-Trichlorophenol
2,4,5-Trichlorophenoxyacetic acid (2,4,5-T)
2,4,5-Trichlorophenoxypropionic acid (2,4,5-TP) (Silvex)
Trichloropropane, N.O.S.
1,2,3-Trichloropropane
O,O,O-Triethyl phosphorothioate
Trinitrobenzene
Tris(1-azridinyl)phosphine sulfide
Tris(2,3-dibromopropyl) phosphate
Trypan blue
Uracil mustard
Urethane
Vanadic acid, ammonium salt
Vanadium pentoxide (dust)
Vinyl chloride
Vinylidene chloride
Zinc cyanide
Zinc phosphide

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N.A.—Waste is hazardous because it meets either the ignitability, corrosivity or reactivity characteristics.

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[1] The abbreviation N.O.S. signifies those members of the general class "not otherwise specified" by name in this listing.

Source: 45 FR 33132-33133, May 19, 1980.

Table B-3. Operations Governed by RCRA Which Have Hazardous Waste Background Documents
Source: 46 FR 4614-4620, January 16, 1981.

Hazardous waste from nonspecific sources.

Industry and EPA hazardous waste no.	Hazardous waste	Hazard Code[a]
Generic:		
F001	The following spent halogenated solvents used in degreasing: tetrachloroethylene, trichoroethylene, methylene chloride, 1,1,1-trichloroethane, carbon tetrachloride, and chlorinated fluorocarbons; and sludges from the recovery of these solvents in degreasing operations	(T)
F002	The following spent halogenated solvents: tetrachloroethylene, methylene chloride, trichloroethylene, 1,1,1-trichloroethane, chlorobenzene, 1,1,2-trichloro-1,2,2-trifluoroethane, ortho-dichlorobenzene, and trichlorofluoromethane; and the still bottoms from the recovery of these solvents	(T)
F003	The following spent non-halogenated solvents: xylene, acetone, ethyl acetate, ethyl benzene, ethyl ether, methyl isobutyl ketone, n-butyl alcohol, cyclohexanone, and methanol; and the still bottoms from the recovery of these solvents	(I)
F004	The following spent non-halogenated solvents: cresols and cresylic acid, and nitrobenzene; and the still bottoms from the recovery of these solvents	(T)
F005	The following spent non-halogenated solvents: toluene, methyl ethyl ketone, carbon disulfide, isobutanol, and pyridine; and the still bottoms from the recovery of these solvents	(I,T)
F006	Wastewater treatment sludges from electroplating operations except from the following processes: (1) sulfuric acid anodizing of aluminum, (2) tin plating on carbon steel; (3) zinc plating (segregated basis) on carbon steel; (4) aluminum or zinc-aluminum plating on carbon steel; (5) cleaning/stripping associated with tin, zinc and aluminum plating on carbon steel; and (6) chemical etching and milling of aluminum	(T)
F019	Wastewater treatment sludges from the chemical conversion coating of aluminum.	(T)
F007	Spent cyanide plating bath solutions from electroplating operations (except for precious metals electroplating spent cyanide plating bath solutions)	(R,T)
F008	Plating bath sludges from the bottom of plating baths from electroplating operations where cyanides are used in the process (except for precious metals electroplating bath sludges)	(R,T)
F009	Spent stripping and cleaning bath solutions from electroplating operations where cyanides are used in the process (except for precious metals electroplating spent stripping and cleaning bath solutions)	(R,T)
F010	Quenching bath sludge from oil baths from metal heat treating operations where cyanides are used in the process (except for precious metals heat-treating quenching bath sludges)	(R,T)
F011	Spent cyanide solutions from salt bath pot cleaning from metal heating operations (except for precious metals heat treating spent cyanide solutions from salt bath pot cleaning)	(R,T)
F012	Quenching wastewater treatment sludges from metal heat treating operations where cyanides are used in the process (except for precious metals heat treating quenching wastewater treatment sludges)	(T)
F014	Cyanidation wastewater treatment tailing pond sediment from minerals metals recovery operations.	(T)
F015	Spent cyanide bath solutions from mineral metals recovery operations.	(R,T)

Table B-3. Operations Governed by RCRA Which Have Hazardous Waste Background Documents (Cont.)
Source: 46 FR 4614-4620, January 16, 1981

Hazardous waste from specific sources.

Industry and EPA hazardous waste no.	Hazardous waste	Hazard Code[a]
Wood preservation:		
K001	Bottom sediment sludge from the treatment of wastewaters from wood preserving processes that use creosote and/or pentachlorophenol	(T)
Inorganic pigments:		
K002	Wastewater treatment sludge from the production of chrome yellow and orange pigments	(T)
K003	Wastewater treatment sludge from the production of molybdate orange pigments	(T)
K004	Wastewater treatment sludge from the production of zinc yellow pigments	(T)
K005	Wastewater treatment sludge from the production of chrome green pigments	(T)
K006	Wastewater treatment sludge from the production of chrome oxide green pigments (anhydrous and hydrated)	(T)
K007	Wastewater treatment sludge from the production of iron blue pigments	(T)
K008	Oven residue from the production of chrome oxide green pigments	(T)
Organic chemicals:		
K009	Distillation bottoms from the production of acetaldehyde from ethylene	(T)
K010	Distillation side cuts from the production of acetaldehyde from ethylene	(T)
K011	Bottom stream from the wastewater stripper in the production of acrylonitrile	(R,T)
K013	Bottom stream from the acetonitrile column in the production of acrylontrile	(T)
K014	Bottoms from the acetonitrile purification column in the production of acrylonitrile	(R,T)
K015	Still bottoms from the distillation of benzyl chloride	(T)
K016	Heavy ends or distillation residues from the production of carbon tetrachloride	(T)
K017	Heavy ends (still bottoms) from the purification column in the production of epichlorohydrin	(T)
K018	Heavy ends from the fractionation column in ethyl chloride production	(T)
K019	Heavy ends from the distillation of ethylene dichloride in ethylene dichloride production	(T)
K020	Heavy ends from the distillation of vinyl chloride in vinyl chloride monomer production	(T)
K021	Aqueous spent antimony catalyst waste from fluoromethanes production	(T)
K022	Distillation bottom tars from the production of phenol/acetone from cumene	(T)
K023	Distillation light ends from the production of phthalic anhydride from naphthalene	(T)
K024	Distillation bottoms from the production of phthalic anhydride from naphthalene	(T)
K093	Distillation light ends from the production of phthalic anhydride from ortho-xylene	(T)
K094	Distillation bottoms from the production of phthalic anhydride from ortho-xylene	(T)
K025	Distillation bottoms from the production of nitrobenzene by the nitration of benzene	(T)
K026	Stripping still tails from the production of methy ethyl pyridines	(T)
K027	Centrifuge and distillation residues from toluene diisocyanate production	(R,T)
K028	Spent catalyst from the hydrochlorinator reactor in the production of 1,1,1-trichloroethane	(T)
K029	Waste from the product steam stripper in the production of 1,1,1-trichloroethane	(T)

Table 8-3. Operations Governed by HCRA Which Have Hazardous Waste Background Documents (Cont.)
Source: 46 FR 4614-4620, January 16, 1981

Hazardous waste from specific sources.

Industry and EPA hazardous waste no.	Hazardous waste	Hazard Code[a]
K095	Distillation bottoms from the production of 1,1,1-trichloroethane	(T)
K096	Heavy ends from the heavy ends column from the production of 1,1,1-trichloroethane	(T)
K030	Column bottoms or heavy ends from the combined production of trichloroethylene and perchloroethylene	(T)
K083	Distillation bottoms from aniline production	(T)
K103	Process residues from aniline extraction from the production of aniline	(T)
K104	Combined wastewater streams generated from nitrobenzene/aniline production	(T)
K085	Distillation or fractionation column bottoms from the production of chlorobenzenes	(T)
K105	Separated aqueous stream from the reactor product washing step in the production of chlorobenzenes	(T)
Inorganic chemicals:		
K071	Brine purification muds from the mercury cell process in chlorine production, where separately prepurified brine is not used	(T)
K073	Chlorinated hydrocarbon waste from the purification step of the diaphragm cell process using graphite anodes in chlorine production	(T)
K106	Wastewater treatment sludge from the mercury cell process in chlorine production	(T)
Pesticides:		
K031	By-product salts generated in the production of MSMA and cacodylic acid	(T)
K032	Wastewater treatment sludge from the production of chlordane	(T)
K033	Wastewater and scrub water from the chlorination of cyclopentadiene in the production of chlordane	(T)
K034	Filter solids from the filtration of hexachlorocyclopentadiene in the production of chlordane	(T)
K097	Vacuum stripper discharge from the chlordane chlorinator in the production of chlordane	(T)
K035	Wastewater treatment sludges generated in the production of creosote	(T)
K036	Still bottoms from toluene reclamation distillation in the production of disulfoton	(T)
K037	Wastewater treatment sludges from the production of disulfoton	(T)
K038	Wastewater from the washing and stripping of phorate production	(T)
K039	Filter cake from the filtration of diethylphosphorodithioic acid in the production of phorate	(T)
K040	Wastewater treatment sludge from the production of phorate	(T)
K041	Wastewater treatment sludge from the production of toxaphene	(T)
K098	Untreated process wastewater from the production of toxaphene	(T)
K042	Heavy ends or distillation residues from the distillation of tetrachlorobenzene in the production of 2,4,5-T	(T)
K043	2,6-Dichlorophenol waste from the production of 2,4-D	(T)
K099	Untreated wastewater from the production of 2,4-D	(T)
Explosives:		
K044	Wastewater treatment sludges from the manufacturing and processing of explosives	(R)
K045	Spent carbon from the treatment of wastewater containing explosives	(R)
K046	Wastewater treatment sludges from the manufacturing, formulation and loading of lead-based initiating compounds	(T)
K047	Pink/red water for TNT operations	(R)

Table B-3. Operations Governed by RCRA Which Have Hazardous Waste Background Documents (Cont.)
Source: 46 FR 4614-4620, January 16, 1981

Hazardous waste from specific sources.

Industry and EPA hazardous waste no.	Hazardous waste	Hazard Code[a]
Petroleum refining:		
K048	Dissolved air flotation (DAF) float from the petroleum refining industry	(T)
K049	Slop oil emulsion solids from the petroleum refining industry	(T)
K050	Heat exchanger bundle cleaning sludge from the petroleum refining industry	(T)
K051	API separator sludge from the petroleum refining industry	(T)
K052	Tank bottoms (leaded) from the petroleum refining industry	(T)
Iron and steel:		
K061	Emission control dust/sludge from the primary production of steel in electric furnaces	(T)
K062	Spent pickle liquor from steel finishing operations	(C,T)
Primary copper:		
K064	Acid plant blowdown slurry/sludge resulting from the thickening of blowdown slurry from primary copper production	(T)
Primary lead:		
K065	Surface impoundment solids contained in and dredged from surface impoundments at primary lead smelting facilities	(T)
Primary zinc:		
K066	Sludge from treatment of process wastewater and/or acid plant blowdown from primary zinc production	(T)
K067	Electrolytic anode slimes/sludges from primary zinc production	(T)
K068	Cadmium plant leachate residue (iron oxide) from primary zinc production	(T)
Secondary lead:		
K069	Emission control dust/sludge from secondary lead smelting	(T)
K100	Waste leaching solution from acid leaching of emission control dust/sludge from secondary lead smelting	(T)
Veterinary pharmaceuticals:		
K084	Wastewater treatment sludges generated during the production of veterinary pharmaceuticals from arsenic or organo-arsenic compounds	(T)
K101	Distillation tar residues from the distillation of aniline-based compounds in the production of veterinary pharmaceuticals from arsenic or organo-arsenic compounds	(T)
K102	Residue from the use of activated carbon for decolorization in the production of veterinary pharmaceutical from arsenic or organo-arsenic compounds	(T)
Ink formulations:		
K086	Solvent washes and sludges, caustic washes and sludges, or water washes and sludges from cleaning tubs and equipment used in the formulation of ink from pigments, driers, soaps, and stabilizers containing chromium and lead	(T)
Coking:		
K060	Ammonia still lime sludge from coking operations	(T)
K087	Decanter tank tar sludge from coking operations	(T)

[a] Hazard Codes: (I) Ignitable Waste, (R) Reactive Waste, and (T) Toxic Waste.

Table B-4

Chemicals Evaluated by OSHA when Monitoring the Workplace
Source: OSHA 1977.

Code	Substance
P 0005	Abate
0010	Acetaldehyde
0020	Acetic acid
0030	Acetic anhydride
0040	Acetone
0060	Acetonitrile
C 0065	2-Acetylaminofluorene
0870	Acetylene dichloride (1,2-dichloroethylene)
0070	Acetylene
0080	Acetylene tetrabromide
0050	Acids, miscellaneous
0090	Acridine
0110	Acrolein
0115	Acrylamide
0120	Acrylonitrile (vinylcyanide)
0125	Aldrin
0130	Allyl alcohol
0140	Allyl chloride
0145	Allyl glycidyl ether
0150	Allyl propyl disulfide
P 0235	Alpha naphthyl thiourea (ANTU)
0160	Aluminum and compounds
C 0162	4-Aminodiphenyl
1030	2-Aminoethanol (ethanolamine)
0165	2-Aminopyridine
0185	Ammate (ammonium sulfamate)
0170	Ammonia
0175	Ammonium chloride
0180	Ammonium nitrate
0185	Ammonium sulfamate (Ammate)
0190	n-Amyl acetate
0191	sec-Amyl acetate
0210	Amyl alcohol
0220	Aniline
0225	Anisidine (o,p-isomers)
0230	Antimony and compounds
0235	ANTU (alpha naphthyl thiourea)
0240	Argon
0260	Arsenic and compounds
0270	Arsine

C - Carcinogen
P - Pesticide

Code	Substance
0290	Asphalt (Petroleum) fumes
P 0300	Azinphos, methyl (Guthion)
P 2690	Azodrin (monocrotophos)
0310	Barium and compounds
0320	Benzene (benzol)
C 0330	Benzidine (and its salts)
0320	Benzol (benzene)
2222	p-Benzoquinone (quinone)
0335	Benzoyl peroxide
0340	Benzyl chloride
0360	Beryllium and compounds
0477	BGE (n-butyl glycidyl ether)
1015	Biphenyl (diphenyl)
2053	Biphenyl mixture (phenyl ether)
C 2630	Bis(chloromethyl) ether
0370	Bismuth and compounds
0380	Boron oxide
0381	Boron tribromide
0382	Boron trifluoride
0390	Bromine
0391	Bromine pentafluoride
0400	Bromoform
0410	Butadiene (1,3-butadiene)
0420	Butane
0480	Butanethiol (butyl mercaptan)
0430	2-Butanone (MEK) (methyl ethyl ketone)
0435	2-Butoxy ethanol (butyl cellosolve)
0440	n-Butyl acetate
0441	sec-Butyl acetate
0442	tert-Butyl acetate
0460	Butyl alcohol
0461	sec-Butyl alcohol
0462	tert-Butyl alcohol
0470	n-Butylamine
0435	Butyl cellosolve (2-butoxy ethanol)
0473	tert-Butyl chromate
0477	n-Butyl glycidyl ether (BGE)
0480	Butyl mercaptan (butanethiol)
0485	p-tert-Butyl toluene
0490	Cadmium (metal dust and soluble salts)
0491	Cadmium oxide (fume)
0500	Calcium arsenate
0505	Calcium carbonate
0510	Calcium cyanamide
0520	Calcium oxide

P - Pesticide
C - Carcinogen

Code	Substance
0522	Camphor
P 0525	Carbaryl (Sevin)
0527	Carbon black
0530	Carbon dioxide
0540	Carbon disulfide
*0560	Carbon monoxide
0570	Carbon tetrachloride (tetrachloromethane)
2070	Carbonyl chloride (phosgene)
P 2670	Carbophenothion (Trithion)
1037	Cellosolve acetate (ethoxyethyl acetate)
0575	Cellulose
0577	Cement, Portland
0610	Cerium
0611	Chlordane
0612	Chlorinated camphene (toxaphene)
0613	Chlorinated diphenyl oxide
0640	Chlorine
0614	Chlorine dioxide
0615	Chlorine trifluoride
0617	Chloroacetaldehyde
0618	a-Chloroacetophenone (phenacylchloride)
0620	chlorobenzene (monochlorobenzene)
0623	o-Chlorobenzylidene malonitrile (OCBM)
0627	Chlorobromomethane
0680	2-Chloro-1, 3-butadiene (chloroprene)
0630	Chlorodiphenyl or Chloronaphthalenes
0645	1-Chloro-2, 3 expoxypropane (epichlorohydrin)
1120	2-Chloroethanol (ethylene chlorohydrin)
2580	Chloroethylene (vinyl chloride)
0670	Chloroform (trichlormethane)
C 2640	Chloromethyl ether (methyl chloromethyl ether)
0660	1-Chloro-1-nitropropane
0675	Chloropicrin (nitrotrichloromethane)
0680	Chloroprene (2-chloro-1, 3-butadiene)
0685	Chromic acid and chromates
0690	Chromium, sol chromic, chromous salts
0710	Coal tar naphtha
0700	Coal tar pitch volatiles
0720	Cobalt and compounds
0730	Copper (fume, dust, or mist)
1016	Corundum (Al203) (emery)
*0735	Cotton dust (raw)
P 0737	Crag
0750	Creosote
0760	Cresol

* - Target Health Hazard
P - Pesticide
C - Carcinogen

Code	Substance
0740	Cresylic acid
0770	Crotonaldehyde
0780	Cumene
0790	Cyanides
0800	Cyanogen
0810	Cycloheane
0820	Cyclohexanol
0830	Cyclohexanone
0840	Cyclohexene
0845	Cyclopentadiene
P 2730	Cygon (Dimethoate)
0846	2,4-D (2,4-dichlorophenoxyacetic acid)
P 0847	DDT
P 0850	DDVP
0853	Decaborane
P 2740	Delnav (Dioxathion)
P 0857	Demeton (Systox)
0923	DGE (diglycidyl ether)
0860	Diacetone alcohol (4-methyl-2-pentanone)
1130	1,2-Diaminoethane (ethylenediamine)
P 2720	Diazinon
0861	Diazomethane
P 0932	Dibrom (dimethyl-1,2-dibromo-2,2-dichloroethyl phosphat
1140	1,2-Dibromoethane (ethylene dibromide)
0863	Dibutyl phosphate
0864	Dibutylphthalate
0865	Dichloracetylene
0867	o-Dichlorobenzene
0868	p-Dichlorobenzene
C 0869	3,3'-Dichlorobenzidine (and its salt)
0871	Dichlorodifluoromethane
0872	1,3-Dichloro-5,5-dimethyl hydantoin
1160	1,1-Dichloroethane (ethylidine chloride)
0874	1,2-Dichloroethane (ethylene dichloride
0870	1,2-Dichloroethylene (acetylene dichloride)
0880	Dichloroethyl ether
1730	Dichloromethane (methylene chloride)
0887	Dichloromonofluoromethane
0890	1,1-Dichloro-1-nitroethane
0846	2,4-dichlorophenoxyacetic acid (2,4-D)
2190	1,2-Dichloropropane (propylene dichloride)
0900	Dichlorotetrafluoroethane
P 0905	Dieldrin
0910	Diethylamine
0920	2-Diethylaminoethanol

P - Pesticide
C - Carcinogen

	Code	Substance
	1010	Diethylene dioxide (dioxane)
	0921	Diethylene triamine
	1210	Diethyl ether (ethyl ether) (ethyl oxide)
	1015	Di(2-ethylhexyl)phthalate (di-sec-octylphthalate)
	0922	Difluorodibromomethane
	0923	Diglycidyl ether (DGE)
	1490	Dihydroxybenzene (hydroquinone)
	0924	Diisobutyl ketone (2,6-dimethylheptanone)
	0925	Diisopropylamine
P	2710	Dimecron (phosphamidon)
P	2730	Dimethoate (Cygon)
	1655	Dimethoxymethane (methylal)
	0927	Dimethyl acetamide
	0928	Dimethylamine
C	0929	4-Dimethylaminoazobenzene
	2600	Dimethylaminobenzene (xylidene)
	0931	Dimethylaniline
	2590	Dimethylbenzene (xylene)
	0932	Dimethyl-1,2-dibromo-2,2-dichloroethyl phosphate (dibrom)
	0930	Dimethylformamide
	0924	2,6-Dimethylheptanone (diisobutyl ketone)
	0940	1,1-Dimethylhydrazine
	1942	Dimethylnitrosoamine (n-nitrosodimethylamine)
	0950	Dimethylphthalate
	0960	Dimethyl sulfate
	0970	Dinitrobenzene
	0975	Dinitro-o-cresol
	0980	Dinitrophenol
	0990	Dinitrotoluene
	1010	Dioxane (diethylene dioxide)
P	2740	Dioxathion (Delnav)
	0926	Diphenyl amine
	1011	Diphenyl (biphenyl)
	1013	Diphenylmethane diisocyanate (methylene bis(phenylene isocyanate) (MDI)
	1014	Dipropylene glycol methyl ether
	1015	Di-sec-octylphthalate (di-2-ethylhexyl phthalate)
P	2680	Di-Syston (disculfoton)
P	2680	Disulfoton (Di-Syston)
	1000	Dyes, misc.
P	2780	Dylox (Trichlorfon)
P	1016	Emery (corundum) (A1203)
	2425	Endosulfan (thiodan)
P	1017	Endrin
	0645	Epichlorohydrin (1-chloro-2,3-epoxypropane)
P	1019	EPN

P - Pesticide
C - Carcinogen

Code	Substance
2215	1,2-Epoxypropane (propylene oxide)
1365	2,3-Epoxy-1-propanol (glycidol)
1020	Epoxy systems, general
1025	Ethane
1220	Ethanethiol (ethyl mercaptan)
1030	Ethanolamine (2-aminoethanol)
P 2750	Ethion
1033	2-Ethoxyethanol (ethylene glycol monoethyl ether)
1037	Ethoxyethyl-acetate (cellosolve acetate)
1040	Ethyl acetate
1050	Ethyl acrylate
1060	Ethyl alcohol
1070	Ethyl amine
1075	Ethyl sec-amyl ketone (5-methyl-3-heptanone)
1080	Ethyl benzene
1090	Ethyl bromide
1100	Ethyl butyl ketone (3-heptanone)
1110	Ethyl chloride
1120	Ethylene chlorohydrin (2-chloroethanol)
1033	Ethylene glycol monoethyl ether (2-ethoxyethanol)
1130	Ethylenediamine (1,2-diaminoethane)
1140	Ethylene dibromide (1,2-dibromoethane)
1160	Ethylene dichloride (1,2-dichloroethane)
1910	Ethylene glycol dinitrate
1170	Ethylene glycol monomethyl ether acetate (methyl cellosolve acetate)
C 1175	Ethylene imine
1190	Ethylene oxide
1210	Ethyl ether (ethyl oxide) (diethyl ether)
1155	Ethyl formate
1160	Ethylidene chloride (1,1-dichloroethane)
1210	Ethyl oxide (ethyl ether) (diethyl ether)
1220	Ethyl mercaptan (ethanethiol)
P 1984	Ethyl parathion (parathion)
1225	Ethylmorpholine
1230	Ethyl silicate
1240	Exhaust of diesel combustion engine (no breakdown)
1260	Exhaust of gasoline combustion engine (no breakdown)
1250	Fabrics, misc.
P 1263	Ferbam
1267	Ferrovanadium dust
1300	Fibrous glass
1280	Fluoride
1270	Fluorine
1285	Fluorotrichloromethane
1290	Formaldehyde

P - Pesticide
C - Carcinogen

	Code	Substance
	1310	Formic acid
	1320	Freon, unspecified
	1330	Furfuryl alcohol
	1340	Gasoline
	1360	Germanium compound
	1363	Glycerine mist
	1365	Glycidol (2,3-epoxy-1-propanol)
	1366	Graphite
P	0300	Guthion (azinphos, methyl)
	1367	Gypsum
	1368	Hafnium
	1400	Helium
P	1369	Heptachlor
	1371	Heptane (n-heptane)
	1675	2-Heptanone (methyl (n-amyl) ketone)
	1100	3-Heptanone (ethyl butyl ketone)
	1372	Hexochloroethane
P	1373	Hexachloronaphthalene
	1370	Hexamylenetetramine
	1380	Hexane (n-hexane)
	1690	2-Hexanone
	1385	Hexone (methyl isobutyl ketone)
	1387	sec-Hexyl acetate
P	1390	Hydrazine
	1405	Hydrochloric acid (muriatic acid)
	1410	Hydrogen
	1420	Hydrogen bromide
	1430	Hydrogen chloride
	1440	Hydrogen cyanide
	1460	Hydrogen fluoride
	1470	Hydrogen peroxide
	1475	Hydrogen selenide
	1480	Hydrogen sulfide
P	2760	Imidan (Prolate)
	1567	IGE (Isopropyl glycidyle ether)
	1500	Indene
	1510	Indium and compounds
	1515	Iodine
	1520	Iron and compounds
	1530	Isoamyl acetate
	1532	Isoamyl alcohol
	1534	Isobutyl acetate
	1536	Isobutyl alcohol
	1538	Isophorone
	1540	Isopropyl acetate

P - Pesticide

Code	Substance
1760	Methylcyclohexanol
1765	o-Methylcyclohexanone
1013	Methylene bis(phenylene isocyanate)(MDI) (diphenylmethane diisocyanate)
C 2650	4,4'-Methylene bis(2-chloroaniline)
1730	Methylene chloride (dichloromethane)
0430	Methyl ethyl ketone (MEK) (2-butanone)
1770	Methyl formate
1075	5-Methyl-3-hepatanone (ethyl sec-amyl ketone)
1772	Methyl iodine
1670	Methyl isobutyl carbinol (methyl amyl alcohol)
1385	Methyl isobutyl ketone (hexone)
1773	Methyl isocyanate
1643	Methyl mercaptan (methanethiol)
1774	Methyl methacrylate
P 1775	Methyl parathion
2010	Methyl propyl ketone (2-pentanone)
1777	Methyl silicate
1778	a-Methyl silicate
P 2065	Mevinphos (phosdrin)
1780	Mineral Spirits
1790	Molybdenum and compounds
P 2690	Monocrotophos (Azodrin)
1972	Monomethyl aniline
1794	Monomethyl hydrazine
1797	Morpholine
1405	Muriactic Acid (hydrochloric acid)
0710	Naphtha (coal tar)
2037	Naphtha (petroleum distillates)
1810	Naphthalene
1815	a-Naththylamine
C 1820	B-Naphthylamine
P 0932	Naled (Dibrom)
1830	Natural gas (L.P.G.) (liquified petroleum gas)
1850	Neon
1840	Nickel metal and soluble compounds
1841	Nickel carbonyl
1855	Nicotine
1860	Nitric acid
1890	Nitric oxide
1865	p-Nitroaniline
1870	Nitrobenzene
1872	p-Nitrochlorobenzene
1877	N-Nitrodimethylamine
C 1875	4-Nitrodiphenyl
1880	Nitroethane

P - Pesticide
C - Carcinogen

Code	Substance
1560	Isopropyl alcohol
1562	Isopropylamine
1565	Isopropylether
1567	Isopropyl glycidyl ether (IGE)
1570	Kerosine (Kerosene)
1575	Ketone
*1590	Lead and compounds
1593	Limestone
P 1595	Lindane
1503	Lithium hydride
1803	L.P.G. (liquified petroleum gas) (natural gas)
1615	Magnesite
1610	Magnesium and compounds
P 1616	Malathion
1618	Meleic anhydride
1620	Manganese and compounds
1652	MAPP (methyl acethylene-propadiene mixture)
1073	MDI (methylene bis (phenylene isocyanate)) (diphenylmethane diisocyanate)
0430	MEK (2-butanone) (methyl ethyl ketone)
1630	Mercury and compounds
1635	Mesityl oxide
P 2700	Meta-Systox R (oxydemetonmethyl)
1640	Methane
1643	Methanethiol (methyl mercaptan)
1660	Methanol (methyl alcohol)
1646	Methoxychlor
0590	2-Methoxyethanol (methyl cellosolve)
1650	Methyl acetate
1651	Methyl acetylene (propyne)
1652	Methyl acetylene-propadiene mixture (MAPP)
1653	Methyl acrylate
1655	Methylal (dimethoxymethane)
1660	Methyl alcohol (methanol)
1665	Methylamine
1670.	Methyl amyl alcohol (methyl isobutyl carbinol)
1675	Methyl (n-amyl) ketone (2-heptanone)
1680	Methyl bromide
1690	Methyl butyl ketone (2-hexanone)
0590	Methyl cellosolve (2-methoxyethanol)
1170	Methyl cellosolve acetate (ethylene glycol monomet ether acetate)
1710	Methyl chloride
1720	Methyl chloroform (1,1,1-trichloroethane)
C 2640	Methyl choromethyl ether (chloromethyl ether)
1735	Methyl 2-cyanoacrylate
1740	Methylcyclohexane

* - Target Health Hazard
P - Pesticide   C- Carcinogen

	Code	Substance
	1900	Nitrogen
	1903	Nitrogen dioxide
	1907	Nitrogen trifluoride
	1912	Nitroglycerine
	1920	Nitromethane
	1930	Nitrophenols
	1940	Nitropropane
C	1942	N-Nitrosodimethylamine (dimethyl nitrosoamine)
	1945	Nitrotoluene
	0675	Nitrotrichloromethane (chloropicrin)
	1953	Nitrous oxide
	0623	OCBM (o-chlorobenzylidene malonitrile)
	1955	Octachloronapthalene
	1957	Octane
	5010	Oil mist
	1960	Osmium tetroxide
	1970	Oxalic acid
P	2700	Oxydemetonmethyl (meta-Systox R)
	1975	Oxygen difluoride
	1980	Ozone
	2000	Paraffin
P	1982	Paraquat
P	1984	Parathion (ethyl parathion)
	1986	Pentaborane
	1987	Pentaerythritol
	1988	Pentachloronaphthelene
	1989	Pentachlorophenol
	1990	Pentane
	2010	2-Pentanone (methyl propyl ketone)
	2020	Perchloroethylene (tetrachloroetylene)
	2030	Perchloromethyl mercaptan
	2033	Perchloryl fluoride
	2037	Petroleum distillates (naphtha)
	0618	Phenacylchloride (A-chloroacetophenone)
	2057	PGE (phenyl glycidyl ether)
	2040	Phenol
	2042	p-Phenylene diamine
	2047	Phenyl ether
	2053	Phenyl ether - biphenyl mixture
	2280	Phenylethylene (styrene monomer)
	2057	Phgnyl glycidyl ether (PGE)
	2060	Phenylhydrazine
P	2770	Phosalone (Zolone)
P	2065	Phosdrin (mevinphos)
	2070	Phosgene (carbonyl chloride)

P - Pesticide
C - Carcinogen

Code	Substance
P 2710	Phosphamidon (Dimecron)
2080	Phospine
2085	Phosphoric acid
2090	Phosphorous
2091	Phosphorous pentachloride
2092	Phosphorous pentasulfide
2093	Phosphorous trichloride
2110	Phthalic anhydride
2120	Picric acid (2,4,6-trinitrophenol)
P 2125	Pival (2-Pivalyl-1,3-indandione)
2127	Plaster of Paris
2100	Plastic decomposition products (unspecified)
2130	Platinum
2135	Polytetrafluoroethylene decomposition products
2137	Potassium bisulfite
2140	Potassium hydroxide
P 2760	Prolate (Imidan)
2150	Propane
2167	Propargyl alcohol
C 2163	B-Propiolactone
2180	n-Propyl acetate
2170	Propyl alcohol
2190	Propylene dichloride (1,2-dichloropropane)
2210	Propylene glycol
2213	Propylene imine
2215	Propylene oxide (1,2-epoxypropane)
2185	n-Propyl nitrate
1651	Propyne (methyl acetylene)
P 2216	Pyrethrum
2220	Pyridine
2222	Quinone (p-benzoquinone)
2224	RDX
2200	Resins, miscellaneous, unless classified elsewhere
2225	Rhodium
2226	Ronnel
P 2228	Rotenone
2229	Rouge
2230	Selenium compounds
2231	Selenium hexafluoride
P 0525	Sevin (carbaryl)
2236	Silicon carbide
2240	Silver and compounds
2245	Sodium bicarbonate
2250	Sodium fluoroacetrade
2260	Sodium hydroxide

P - Pesticide
C - Carcinogen

Code	Substance
2263	Starch
2267	Stibine
2270	Stoddard solvent
2275	Strychnine
2280	Styrene monomer (phenylethylene)
2290	Sulfur dioxide
2300	Sulfur hexafluoride
2310	Sulfuric acid
2320	Sulfur monochloride
2321	Sulfur pentafluoride
2323	Sulfuryl fluoride
P 0857	Systox (Demeton)
2324	2,4,5-T (2,4,5-trichlorophenoxyacetic acid)
2325	Tantalum
P 2327	TEDP
2329	Teflon decomposition products
2330	Tellurium
2332	Tellurium hexafluoride
P 2334	TEPP
2335	Terphenyls
2337	1,1,1,2-Tetrachloro-2,2-difluoroethane
2339	1,1,2,2-Tetrachloro-1,2-difluoroethane
2340	1,1,2,2-Tetrachloroethane
2020	Tetrachloroethylene (perchloroethylene)
0570	Tetrachloromethane (cardon tetrachloride)
2350	Tetrachloronaphthalene
2360	Tetraethyl lead
2390	Tetrahydrofuran
2370	Tetramethyl lead
2380	Tetramethyl succinonitrile
2395	Tetranitromethane
2410	Tetryl (2,4,6-trinitrophenylmethylnitramine)
2420	Thallium
P 2425	Thiodan (endosulfan)
2427	Thiram
2430	Tin (inorganic - except tin oxide)
2431	Tin (organic compounds)
2432	Tin oxide
2440	Titanium dioxide and other titanium compounds
2460	Toluene (toluol)
2470	Toluene-2,4-diisocyanate
2475	o-Toluidine
2460	Toluol (Toluene)
P 0612	Toxaphene (chlorinated camphene)

P - Pesticide

Code	Substance
2477	Tributyl phosphate
P 2780	Trichlorfon (Dylox)
1720	1,1,1-Trichloroethane (methyl chloroform)
2495	1,1,2-Trichloroethane
2490	Trichloroethylene
0670	Trichloromethane (chloroform)
2483	Trichloronaphthalene
2324	2,4,5-Trichlorophenoxyacetic acid (2,4,5-T)
2510	1,2,3-Trichloropropane
2485	1,1,2-Trichloro 1,2,2-trifluoroethane
2480	Triethylamine
2500	Trifluoromonobromomethane
2120	2,4,6-Trinitrophenol (picric acid)
2410	2,4,6-Trinitrophenylmethylnitramine (tetryl)
2530	Trinitrotoluene
2532	Triorthocresyl phosphate
2535	Triphenyl phosphate
P 2670	Trithion (carbophenothion)
2537	Tungsten and compounds
2540	Turpentine
2560	Uranium and compounds
2570	Vanadium and compounds
2575	Vinyl benzene
2580	Vinyl chloride (chloroethylene)
0120	Vinylcyanide (acrylonitrile)
2582	Vinyl toluene
P 2586	Warfarin
2590	Xylene (dimethylbenzene)
2600	Xylidine (dimethylaminobenzene)
2602	Yttrium
2606	Zinc and compounds
2611	Zinc chloride
2610	Zinc oxide (fume)
2620	Zirconium compounds
P 2770	Zolone (Phosalone)

P - Pesticide

I. Unidentified Chemicals

Code	Substance
5440	Bleach
5340	Brake fluid mist
5130	Carburetor cleaner
5250	Caustic cleaner mist
5240	Cosmetic solvent vapor
5140	Degreaser
5400	Detergent
5330	Drilling fluid mist
5360	Duplicator vapors
5210	Dye
5220	Dye solvent vapor
5450	Enzyme
5170	Explosives
5150	Fabric plasticisers, modifiers and finishers
5160	Flavoring agents
5320	Flux
5100	General solvent vapor-
5348	Glue
5350	Glue vapors
5015	Grease
5029	Ink
5030	Ink mist
5230	Ink solvent vapor
5310	Metal fume
5370	Microbiological pathogens
5009	Oil
5010	Oil mist
5390	Paint and Varnish thermal decomposition products
5180	Paint mist
5110	Paint thinner
5345	Pesticide, unspecified
5260	Photographic developer vapor
5280	Plant and food products
5270	Rubber accelerators and anti-oxidants
5410	Soap
5460	Stainless Steel (composition unknown or unspecified)
5430	Tar
5120	Type cleaner
5420	Wax
5380	Welding gases, unspecified (ozone, NOx, CO, CO_2)
5930	Other alcohols
5950	Other solvents
5999	Other and unidentified chemicals

II. Physical Hazards

Code	Source
8110	Noise, continuous
8120	Noise, intermittent
8130	Noise, impact
8140	Noise, ultrasonic
8150	Vibration
8260	Alpha radiation
8270	Beta radiation
8220	Gamma radiation - sealed source
8280	Gamma radiation - unsealed
8210	X-radiation
8290	Other ionizing radiation
8310	Exposure to cold
8320	Heat stress - dry
8330	Heat stress - humid
8390	Improper Illumination
8380	Infrared
8350	Long wave Radio-frequency
8340	Microwave
8360	Sunlight
8370	Ultra-violet
8510	Lasers - infrared
8505	Lasers - microwave and RF
8590	Lasers - ultraviolet
8530	Lasers - visible
8600	Lasers - X-radiation
8410	Low pressure
8420	High pressure
8970	Electrical shock
8880	All other physical hazards

IV. Dust

Code	Substance
*9010	Crystalline Free Silica
*9013	Fused Silica
*9015	Cristobalite
*9017	Tridymite
*9050	Amorphus Silica, including diatomaceous earth
*9020	Asbestos
9140	Brass Dust (composition unknown or unspecifie
9150	Brick Dust
9160	Clay Dust
9040	Coal
9220	Dust containing enzymes
9200	Flour Dust
9090	Graphite
9120	Leather
9075	Mica
9170	Mortar Dust
9100	Organic Dust
9180	Plastic Dust
0577	Portland Cement
9190	Rubber Dust
9085	Soapstone
9030	Talc
9087	Tremolite
9210	Wood - Sawdust
9130	Inert or nuisance dust, not elsewhere classif

* Target Health Hazard

Table B-5

Chemicals and Chemical Compounds Reviewed by NIOSH by the NOHS Database *

Mnemonic Code	Code	Name
	92020	ABRASIVE
	92015	ABRASIVE SHOT
	92021	ABSORBENT
	92845	ACCELERATOR, RUBBER
ACAL	01038	ACETALDEHYDE
	80015	ACETATE
HAC	01568	ACETIC ACID
AC20	02740	ACETIC ANHYDRIDE
ACETO	02820	ACETONE
ACCY	02830	ACETONE CYANOHYDRIN
	02900	ACETONITRILE
	03195	2-ACETYLAMINOFLUORINE
ACETY	03298	ACETYLENE
	03350	ACETYLENE DICHLORIDE (1, 2-DICHLOROETHYLENE)
	03355	ACETYLENE TETRABROMIDE
TCE	73790	ACETYLENE TRICHLORIDE (TRICHLOROETHYLENE)
	90050	ACIDS
	03490	ACRIDINE
	03530	ACROLEIN
	03540	ACRYLAMIDE
	03570	ACRYLIC ACID
ACRYL	03800	ACRYLONITRILE (VINYL CYANIDE)
	03895	ACTIVATED SLUDGE
	03897	ACTIVATOR
	92030	ADHESIVE
	04065	AEROSOL CLEANER
AP	92770	AEROSOL PROPELLANT
	80016	AIR FRESHENER
	80039	AJAX
	04235	ALCOHOL
	80108	ALCOHOL-DENATURED
	04260	ALDRIN
	80090	ALIPHATIC HYDROCARBONS
ABDAC	04280	ALKYL BENZYL DIMETHYL AMMONIUM CHLORIDE
ADEBAC	80085	ALKYL DIMETHYL ETHYL BENZYL AMMONIUM CHLORIDE
ALLOH	04370	ALLYL ALCOHOL
ALCL	04460	ALLYL CHLORIDE
AGE	04530	ALLYL GLYCIDYL ETHER
	04590	ALLYL PROPYL DISULFIDE (ONION OIL)
AL203	20265	ALUMINA (ALUMINUM OXIDE; CORUNDUM; EMERY)
AL	04603	ALUMINUM
	04605	ALUMINUM CHLORIDE
AL203	20265	ALUMINUM OXIDE (ALUMIDE; CORUNDUM; EMERY)
ALOX	04608	ALUMINUM, OXIDES OF
	80037	ALUMINUM STEARATE
	80177	AMINE
	04975	4-AMINODIPHENYL
	04980	2-AMINOETHANOL
	05215	2-AMINOPYRIDINE
	06190	AMMATE (AMMONIUM SULFAMATE)

*See Appendix A for further informatin on the NOHS Data Base.

Mnemonic Code	Code	Name
NH3	05250	AMMONIA
NH4CL	05270	AMMONIUM CHLORIDE
	80038	AMMONIUM COMPOUNDS
	06063	AMMONIUM DICHROMATE
NH4OH	06145	AMMONIUM HYDROXIDE
NHNO	06163	AMMONIUM NITRATE
	06175	AMMONIUM PERSULFATE
	80158	AMMONIUM SULFATE
	06190	AMMONIUM SULFAMATE (AMMATE)
	06320	n-AMYL ACETATE
	06323	sec-AMYL ACETATE
	06330	AMYL ALCOHOL
ANIL	06580	ANILINE
	06985	ANIMAL PRODUCTS, NEC
	07040	ANISIDINE (o and p-isomers)
	92040	ANTIFREEZE
SB	07310	ANTIMONY
SBHB	69800	ANTIMONY HYDRIDE
SB203	07325	ANTIMONY OXIDE
SBOX	07328	ANTIMONY, OXIDES OF
SBCL3	07405	ANTIMONY TRICHLORIDE
	07415	ANTIOFFSET AND SMOOTH LAY COMPOUND
	92850	ANTIOXIDANT
	92050	ANTITOXICANT
	07465	APLITE
A	07485	ARGON
AH	80027	AROMATIC HYDROCARBONS
AS	07545	ARSENIC
ASOX	07555	ARSENIC, OXIDES OF
ASO3	07570	ARSENIC TRIOXIDE
ASH3	07580	ARSINE
	90310	ASBESTOS
	90320	ASPHALT
	35750	AZINPHOS, METHYL (GUTHION)
	92060	BACTERICIDE
	08525	BACTERIOSTAT
	40370	BANANA OIL (ISOAMYL ACETATE)
BA	08625	BARIUM
BACL	08650	BARIUM CHLORIDE
	90330	BARIUM COMPOUNDS
BAOH	08655	BARIUM HYDROXIDE
BAOX	08658	BARIUM, OXIDES OF
	08705	BASE
	80040	BELT DRESSING
	90340	BENTONITE
BEN	09070	BENZENE (BENZOL)
	25710	1, 4-BENZENEDIOL (p-HYDROQUINONE; p-DIHYDROXY BENZENE; HYDROQUINOL; QUINOL)
	09318	BENZENE HEXACHLORIDE (LINDANE)
	09830	BENZIDINE
BEN	09070	BENZOL (BENZENE)
	10920	p-BENZOQUINONE
	11280	BENZOYL PEROXIDE
	11600	BENZYL CHLORIDE
BE	11770	BERYLLIUM

Mnemonic Code	Code	Name
	90350	BERYLLIUM COMPOUNDS
BEOX	11855	BERYLLIUM, OXIDES OF
	90360	BERYLLIUM SALTS
	92070	BINDER-ABRASIVE WHEEL
	12065	BINDER-FOUNDRY
	92080	BIOCIDE
BIO	12068	BIOLOGICAL SUBSTANCES, NEC
	27590	BIPHENYL (DIPHENYL)
BI	12783	BISMUTH
	12785	BISMUTH CHLORIDE
	90370	BISMUTH COMPOUNDS
BIOX	12795	BISMUTH, OXIDES OF
BI2O3	12798	BISMUTH OXIDE
	12845	BISPHENOL A
	92090	BLEACH
	92100	BLEACHING AGENT
	92110	BLENDING AGENT
BWTC	80087	BOILER WATER TREATMENT CHEMICAL
	12940	BORAX
H3BO3	12960	BORIC ACID
	12961	BORON CARBIDE
	90380	BORON HYDRIDES
B2O3	12963	BORON OXIDE
BOX	12964	BORON, OXIDES OF
BBR3	12966	BORON TRIBROMIDE
BCL3	12970	BORON TRICHLORIDE
BF3	12980	BORON TRIFLUORIDE
	12985	BORON TRIFLUORIDE COMPLEXES
BC	80086	BOWL CLEANER
	92120	BRAKE FLUID
BRASS	90400	BRASS, CU, ZN, PB GROUP
BRASO	13025	BRASS, OXIDES OF
	90410	BRICK
	80012	BRIGHTENER
	90420	BRINE
BR	13100	BROMINE
	13103	BROMINE PENTAFLUORIDE
	31900	BROMOETHANE (ETHYL BROMIDE)
	13160	BROMOFORM
BRNZE	90430	BRONZE-CU, SN, PB GROUP
BRNZO	13275	BRONZE, OXIDES OF
	80116	BUFFER
	52136	BUNKER FUEL (OIL, FUEL NO. 6)
CAO	15755	BURNT LIME (CALCIUM OXIDE; UNSLAKED LIME; CALX; QUICKLIME)
BUT	13410	BUTADIENE
BUT	13410	1, 3-BUTADIENE
	13480	BUTANE
	13785	BUTANETHIOL (BUTYL MERCAPTAN)
	13850	n-BUTANOL
MEK	13980	2-BUTANONE (METHYL ETHYL KETONE)
	14143	1-BUTENE
	14144	2-BUTENE
	29930	2-BUTOXYETHANOL (BUTYL CELLOSOLVE)
	14380	BUTYL ACETATE
	14380	n-BUTYL ACETATE

Mnemonic Code	Code	Name
	14382	sec-BUTYL ACETATE
	14384	tert-BUTYL ACETATE
	14420	BUTYL ALCOHOL
2BUTA	14410	sec-BUTYL ALCOHOL
	14400	tert-BUTYL ALCOHOL
	14865	n-BUTYLALDEHYDE
	14440	BUTYLAMINE
	14444	tert-BUTYLAMINE
	29930	BUTYL CELLOSOLVE (2-BUTOXYETHANOL)
	14655	tert-BUTYL CHROMATE
BGE	14720	n-BUTYL GLYCIDYL ETHER
	13785	BUTYL MERCAPTAN (BUTANETHIOL)
	14930	p-tert-BUTYLTOLUENE
CD	15570	CADMIUM
	90440	CADMIUM COMPOUNDS
CDOX	15630	CADMIUM, OXIDES OF
	90450	CADMIUM SALTS-SOLUBLE
	80041	CALCIUM
	15700	CALCIUM ARSENATE
CAC2	15703	CALCIUM CARBIDE
CACO3	15705	CALCIUM CARBONATE (LIMESTONE)
CACL2	15720	CALCIUM CHLORIDE
	15730	CALCIUM CYANAMIDE
CAOH2	15743	CALCIUM HYDROXIDE (HYDRATED LIME; SLAKED LIME)
CAOCL	15746	CALCIUM HYPOCHLORITE
CAO	15755	CALCIUM OXIDE (UNSLAKED LIME; CALX; QUICKLIME; BURNT LIME)
	80042	CALCIUM SILICATE
	15765	CALCIUM STEARATE
CAO	15755	CALX (CALCIUM OXIDE; UNSLAKED LIME; QUICKLIME; BURNT LIME)
	90460	CARBAMATES
	47800	CARBARYL (SEVIN; 1-NAPHTHYL-n-METHYL CARBAMATE)
	20930	CARBODIIMIDE (CYANAMIDE)
PHEN	55460	CARBOLIC ACID (PHENOL)
WGASE	17389	CARBON ARC LAMP GASES
	17388	CARBOMETHANE
	17370	CARBON BISULFIDE (CARBON DISULFIDE)
CB	17360	CARBON BLACK
CO2	17367	CARBON DIOXIDE
CS2	17370	CARBON DISULFIDE (CARBON BISULFIDE)
	17385	CARBON HEXACHLORIDE (HEXACHLOROETHANE; PERCHLOROETHANE; CARBON TRICHLORIDE)
CO	17460	CARBON MONOXIDE
	17475	CARBON STEEL (STEEL)
CCL4	17490	CARBON TETRACHLORIDE (TETRACHLOROMETHANE)
	17385	CARBON TRICHLORIDE (CARBON HEXACHLORIDE; HEXACHLOROETHANE; PERCHLOROETHANE)
COCL2	57710	CARBONYL CHLORIDE (PHOSGENE)
SIC	17525	CARBORUNDUM (SILICON CARBIDE)
	90470	CARBOXYLIC ACIDS
	92130	CARBURETOR CLEANER
	17595	CARPET CLEANER
	92135	CATALYST
	80025	CAULKING COMPOUND
	92140	CAUSTIC CLEANER
KOH	60440	CAUSTIC POTASH (POTASSIUM HYDROXIDE)

Mnemonic Code	Code	Name
NAOH	69070	CAUSTIC SODA (LYE; SODIUM HYDROXIDE)
	32450	CELLOSOLVE-SOLVENT (ETHYLENE GLYCOL MONOETHYL ETHER)
	46930	CELLOSOLVE ACETATE (ETHYLENE GLYCOL MONOETHYL ETHER ACETATE)
	90480	CELLULOID
	17683	CELLULOSE
	17685	CELLULOSE NITRATE (NITROCELLULOSE)
	17694	CEMENT-GLUE
	17695	CEMENT-PORTLAND
	17745	CERIUM
	17775	CESIUM
	17855	CHALK
	17857	CHARCOAL
	92150	CHELATING AGENT
	51590	CHLORDANE
	73500	CHLORINATED CAMPHENE (TOXAPHENE)
	18035	CHLORINATED DIPHENYL OXIDE
CH	90500	CHLORINATED HYDROCARBONS
CL	18040	CHLORINE
CLO2	18045	CHLORINE DIOXIDE
CLF3	18050	CHLORINE TRIFLUORIDE
	18065	CHLOROACETALDEHYDE
	18070	CHLOROACETIC ACID
	18080	a-CHLOROACETOPHENONE (PHENACYLCHLORIDE)
CLBE	18190	CHLOROBENZENE (MONOCHLOROBENZENE)
OCBM	18240	o-CHLOROBENZYLIDENE MALONITRILE
	18250	CHLOROBROMOMETHANE
	18260	2-CHLORO-1, 3-BUTADIENE (CHLOROPRENE)
	18393	CHLORODIPHENYL
	90510	CHLORODIPHENYLS
	20901	1-CHLORO-2, 3-EPOXYPROPANE
ECL	31970	CHLOROETHANE (ETHYL CHLORIDE)
	18400	2-CHLOROETHANOL
VCL	76445	CHLOROETHYLENE (VINYL CHLORIDE)
	18500	CHLOROFORM (TRICHLOROMETHANE)
	90530	CHLORONITRO ANILINES
	90540	CHLORONITRO BENZENES
	18590	1-CHLORO-1-NITROPROPANE
	18710	CHLOROPICRIN (NITROTRICHLOROMETHANE)
	18260	CHLOROPRENE (2-CHLORO-1, 3-BUTADIENE)
	29010	CHLOROPROPYLENE OXIDE
	73760	CHLOROTHENE
	90550	CHROMATES
	90560	CHROME PLATING COMPOUND
H2CRO	19360	CHROMIC ACID
	90570	CHROMIC SALTS (CHROMIUM SALTS, CHROMOUS SALTS)
	19395	CHROMIUM
	90580	CHROMIUM COMPOUNDS
CROX	19425	CHROMIUM, OXIDES OF
	90570	CHROMIUM SALTS (CHROMOUS SALTS, CHROMIC SALTS)
CRO3	19430	CHROMIUM TRIOXIDE
	90570	CHROMOUS SALTS (CHROMIC SALTS, CHROMIUM SALTS)
	19680	CITRIC ACID
	90590	CLAY
CC	92160	CLEANING COMPOUND
NAOCL	69090	CLOROX (SODIUM HYPOCHLORITE)

Mnemonic Code	Code	Name
	92170	COAGULATOR
	19765	COAGULANT
	90600	COAL (Anthracite)
	19767	COAL (Bituminous)
	90610	COAL TAR
	90620	COAL TAR PITCH VOLATILES
	19769	COATING
	19770	COBALT
	90630	COBALT COMPOUNDS
	19935	COKE
	80004	COLORING AGENT
	19985	COLUMBIUM (NIOBIUM)
	19995	COMET
	80030	CONCRETE
	20063	CONTACT CEMENT
	20064	CONTACT CLEANER-ELECTRICAL
	92175	COOLANT
CU	20115	COPPER
	90640	COPPER COMPOUNDS
CUCN	20155	COPPER CYANIDE
CUOX	20170	COPPER, OXIDES OF
	92180	COPY MACHINE FLUID
	20245	CORK
	80018	CORRECTION FLUID
	92185	CORROSION INHIBITOR
AL203	20265	CORUNDUM (ALUMINUM OXIDE; ALUMINA; EMERY)
	92190	COSMETIC SOLVENT
	94040	COTTON
	68970	CRAG HERBICIDE
	90650	CREOSOTE-MIXED PHENOLS
CRE	20380	CRESOL (CRESYLIC ACID)
CRE	20380	CRESYLIC ACID (CRESOL)
	20627	CROCCUS
	20630	CROTONALDEHYDE
	20810	CRYOLITE
	20850	CUMENE
	80020	CURING AGENT
	52131	CUTTING FLUID
	20930	CYANAMIDE (CARBODIIMIDE)
	90670	CYANIDES
	90680	CYANIDE SOLUTION
	20970	CYANOGEN (ETHANE DINITRILE)
	90690	CYCLOALKANES
CYC	21190	CYCLOHEXANE
	21560	CYCLOHEXANOL (HEXAHYDROPHENOL)
	21660	CYCLOHEXANONE (KETOHEXAMETHYLENE)
	80043	CYCLOHEXANONE PEROXIDE
	21705	CYCLOHEXENE
C5H6	20065	CYCLOPENTADIENE
RDX	22210	CYCLOTRIMETHYLENE TRINITRAMINE
	24270	2, 4-D (2, 4-DICHLOROPHENOXYACETIC ACID)
DDT	73750	DDT (DICHLORODIPHENYLTRICHLOROMETHANE)
DDVP	24440	DDVP (DICHLORVOS)
DP-ACF	80187	DECOMPOSITION PRODUCTS-ACID CORE FLUX
DP-F	80125	DECOMPOSITION PRODUCTS-FLUX

Mnemonic Code	Code	Name
DP-G	22734	DECOMPOSITION PRODUCTS-GENERAL (NOTE: The above is used in a NOTE, only when neither of the following DP's are appropriate.)
	80127	DECOMPOSITION PRODUCTS-METAL COATING
DP-CO	22736	DECOMPOSITION PRODUCTS-OIL, CUTTING
DP-O	22737	DECOMPOSITION PRODUCTS-OIL, GENERAL
DP-HO	22738	DECOMPOSITION PRODUCTS-OIL, HYDRAULIC
DP-LO	22739	DECOMPOSITION PRODUCTS-OIL, LUBE
DP-PO	22741	DECOMPOSITION PRODUCTS-OIL, PENETRATING
DP-QO	22742	DECOMPOSITION PRODUCTS-OIL, QUENCH
DP-VO	22743	DECOMPOSITION PRODUCTS-OIL, VEGETABLE
DP-PA	92635	DECOMPOSITION PRODUCTS-PAINT
DP-BUT	22745	DECOMPOSITION PRODUCTS-POLYMER, BUTADIENE RUBBER
DP-POL	22746	DECOMPOSITION PRODUCTS-POLYMER, GENERAL
DP-ISO	22747	DECOMPOSITION PRODUCTS-POLYMER, NATURAL RUBBER
DP-N	80138	DECOMPOSITION PRODUCTS-POLYMER, NYLON
DP-NEO	22748	DECOMPOSITION PRODUCTS-POLYMER, NEOPRENE RUBBER
DP-PY	80137	DECOMPOSITION PRODUCTS-POLYMER, POLYESTER
DP-PE	22749	DECOMPOSITION PRODUCTS-POLYMER, POLYETHYLENE
DP-PS	22751	DECOMPOSITION PRODUCTS-POLYMER, POLYSTYRENE
DP-TEF	60925	DECOMPOSITION PRODUCTS-POLYMER, POLYTETRAFLUOROETHYLENE
DP-PU	22753	DECOMPOSITION PRODUCTS-POLYMER, POLYURETHANE
DP-PVC	22754	DECOMPOSITION PRODUCTS-POLYMER, POLYVINYL CHLORIDE
DP-PR	22755	DECOMPOSITION PRODUCTS-RESIN, PHENOLIC
DP-UR	22756	DECOMPOSITION PRODUCTS-RESIN, UREA-FORMALDEHYDE
DP-RCF	80126	DECOMPOSITION PRODUCTS-ROSIN CORE FLUX
DP-V	92965	DECOMPOSITION PRODUCTS-VARNISH
DP-WF	80174	DECOMPOSITION PRODUCTS-WRAPPING FILM
	92200	DEFOAMER AGENT
	92210	DEFOLIANT
	92220	DEGREASER
	92230	DEHAIRING AGENT
	22840	DEMETON (SYSTOX)
	92240	DENATURANT
	80006	DEOXIDIZER
	92250	DESCUMMING AGENT
	92255	DETERGENT
	80095	DEVELOPER
DAAL	23010	DIACETONE ALCOHOL (4-HYDROXY-4-METHYL-2-PENTANONE)
	38110	DIAMINE (HYDRAZINE; 1, 1-DIMETHYLHYDRAZINE)
	23230	1, 2-DIAMINOETHANE
	80045	DIAMMONIUM HYDROGEN PHOSPHATE
	23275	DIAMOND
	23304	DIATOMACEOUS EARTH-NATURAL
	23370	DIAZOMETHANE
B2H6	23650	DIBORANE
	26420	DIBROM (DIMETHYL 1, 2-DIBROMO-2, 2-DICHLOROETHYL PHOSPHATE)
EDBR	23660	1, 2-DIBROMOETHANE (ETHYLENE DIBROMIDE)
	23865	DIBUTYL PHOSPHATE
	23870	DIBUTYL PHOSPHITE
	23880	DIBUTYLPHTHALATE
	23980	DICHLOROACETYLENE
	24003	o-DICHLOROBENZENE
	24006	p-DICHLOROBENZENE
	24025	3, 3-DICHLOROBENZIDINE

Mnemonic Code	Code	Name
DCDFM	24095	DICHLORODIFLUOROMETHANE (FREON 12)
	24100	1, 3-DICHLORO-5, 5-DIMETHYLHYDANTOIN
DDT	73750	DICHLORODIPHENYLTRICHLOROETHANE (DDT)
EDCL	24120	1, 1-DICHLOROETHANE (ETHYLIDENE CHLORIDE)
	24130	1, 2-DICHLOROETHANE
	03350	1, 2-DICHLOROETHYLENE (ACETYLENE DICHLORIDE)
	24150	2, 2-DICHLOROETHYL ETHER
	24185	DICHLOROFLUOROMETHANE
MECL2	47270	DICHLOROMETHANE (METHYLENE CHLORIDE)
	24235	DICHLOROMONOFLUOROMETHANE (FREON 21)
	24255	1, 1-DICHLORO-1-NITROETHANE
	24270	2, 4-DICHLOROPHENOXYACETIC ACID (2, 4-D)
	24390	1, 2-DICHLOROPROPANE
	24425	DICHLOROTETRAFLUOROETHANE
DDVP	24440	DICHLORVOS (DDVP)
	24600	DIELDRIN
	52132	DIESEL FUEL
	24615	DIETHANOLAMINE
	24680	DIETHYLAMINE
	24930	DIETHYLAMINO ETHANOL
	25145	DIETHYLENE DIOXIDE (1, 4-DIOXANE)
DEG	25545	DIETHYLENE GLYCOL (DIGLYCOL)
	25210	DIETHYLENE TRIAMINE
	32590	DIETHYL ETHER (ETHYL ETHER).
DEHP	25365	DI (2-ETHYLHEXYL) PHTHALATE (DI-sec-OCTYL PHTHALATE)
	25515	DIFLUORODIBROMOMETHANE
DGE	12846	DIGLYCIDYL ETHER
	25545	DIGLYCOL (DIETHYLENE GLYCOL)
	25710	DIHYDROXYBENZENE (1, 4-BENZENEDIOL, p-HYDROQUINONE)
	25820	DIISOBUTYL KETONE (2, 6-DIMETHYHEPTANONE)
	25850	DIISOPROPYL AMINE
	25905	DIISOPROPYL ETHER (ISOPROPYL ETHER)
	26075	DIMETHOXYMETHANE (METHYLAL)
	26095	N, N-DIMETHYL ACFTAMIDE
	26130	DIMETHYLAMINE
	26175	4-DIMETHYLAMINOAZOBENZENE
	76910	DIMETHYLAMINOBENZENE (XYLIDENE)
	26335	N, N-DIMETHYLANILINE
	26350	DIMETHYL BENZENE
IPAL	40987	DIMETHYL CARBINOL (ISOPROPYL ALCOHOL, ISOPROPANOL)
	80083	3, 5-DIMETHYL-4-CHLOROPHENOL
	26420	DIMETHYL-1, 2-DIBROMO-2, 2-DICHLOROETHYL PHOSPHATE (DIBROM)
	26560	DIMETHYL FORMAMIDE
	25820	2, 6-DIMETHYLHEPTANONE (DIISOBUTYL KETONE)
	38110	1, 1-DIMETHYLHYDRAZINE (DIAMINE, HYDRAZINE)
	26615	DIMETHYLMETHANE (PROPANE)
	26735	DIMETHYL NITROSOAMINE
	59210	DIMETHYL PHTHALATE
	26880	DIMETHYL SULFATE
	27046	m-DINITROBENZENE
	27048	o-DINITROBENZENE
	27050	p-DINITROBENZENE
	27080	4, 6-DINITRO-o-CRESOL
	27110	2, 4-DINITROPHENOL
	80046	DINITROPHENYL CHROMATE

Mnemonic Code	Code	Name
	27125	2, 4-DINITROTOLUENE
	25145	1, 4-DIOXANE (DIETHYLENE DIOXIDE)
	27590	DIPHENYL (BIPHENYL)
	27615	DIPHENYLAMINE
	27705	DIPHENYLCARBAZONE
MDI	27780	DIPHENYLMETHANE DIISOCYANATE (METHYLENE BISPHENYL ISOCYANATE)
HEP	36060	DIPROPYL METHANE (HEPTANE, HEPTYL HYDRIDE)
DEHP	25365	DI-sec-OCTYL PHTHALATE (DI(2-ETHYLHEXYL) PHTHALATE)
	92260	DISINFECTANT
	80165	DOLOMITE
	80019	DRAIN OPENER
	28673	DRAINO
	92270	DRILLING FLUID
	92280	DUPLICATOR FLUID
	92290	DYE
	92300	DYE SOLVENT
	92310	DYE STUFF
	90710	DYNAMITE
	28805	ELASTIC
	28807	EMBALMING FLUID
	28808	EMBALMING PREPARATION FLUID
AL203	20265	EMERY (ALUMINUM OXIDE, ALUMINA, CORUNDUM)
	92320	EMULSIFIER
	28855	ENAMEL
	28880	ENDOSULFAN (THIODAN)
	36630	ENDRIN
	93060	ENZYMES
ECH	29010	EPICHLOROHYDRIN
	90720	EPOXY
	90730	EPOXY COMPOUNDS
EO	32550	1, 2-EPOXYETHANE (ETHYLENE OXIDE)
PLO	63550	1, 2-EPOXYPROPANE (PROPYLENE OXIDE)
	35120	2, 3-EPOXY-1-PROPANOL (GLYCIDOL)
	90740	EPOXY RESINS
	80120	ERADICATOR
	92860	ERUSTICATOR (RUST REMOVER)
	90750	ESTERS
	80026	ETCHING COMPOUND
	29325	ETHANE
	20970	ETHANE DINITRILE (CYANOGEN)
	32760	ETHANETHIOL (ETHYL MERCAPTAN)
ETOH	31500	ETHANOL (ETHYL ALCOHOL)
EAM	04980	ETHANOLAMINE (MONOETHANOLAMINE)
	90760	ETHERS
	31350	2-ETHOXYETHANOL
	31390	2-ETHOXYETHYLACETATE
ETAC	31470	ETHYL ACETATE
EAC	31490	ETHYL ACRYLATE
ETOH	31500	ETHYL ALCOHOL (ETHANOL)
	31520	ETHYLAMINE
	31800	ETHYL sec-AMYL KETONE
EB	31830	ETHYL BENZENE
	31900	ETHYL BROMIDE (BROMOETHANE)
EBK	36330	ETHYL BUTYL KETONE (3-HEPTANONE)

Mnemonic Code	Code	Name
ECL	31970	ETHYL CHLORIDE (CHLOROETHANE)
	32200	ETHYLENE CHLOROHYDRIN
	32220	ETHYLENEDIAMINE
EDBR	23660	ETHYLENE DIBROMIDE (1, 2-DIBROMOETHANE)
EG	32385	ETHYLENE GLYCOL
	80171	ETHYLENE GLYCOL DINITRATE
	32450	ETHYLENE GLYCOL MONOETHYL ETHER (CELLOSOLVE-SOLVENT)
	46930	ETHYLENE GLYCOL MONOETHYL ETHER ACETATE (CELLOSOLVE ACETATE)
	32470	ETHYLENE GLYCOL MONOMETHYL ETHER (METHYL CELLOSOLVE)
	46935	ETHYLENE GLYCOL MONOMETHYL ETHER ACETATE (METHYLCELLOSOLVE ACETATE)
	32520	ETHYLENE IMINE
EO	32550	ETHYLENE OXIDE (1, 2-EPOXYETHANE)
	32590	ETHYL ETHER (DIETHYL ETHER)
	32610	ETHYL FORMATE (FORMIC ETHER)
2EH	32645	2-ETHYL-HEXANOL (2-ETHYLHEXYL ALCOHOL)
2EH	32645	2-ETHYLHEXYL ALCOHOL (2-ETHYL-HEXANOL)
EDCL	24120	ETHYLIDENE CHLORIDE (1, 1-DICHLOROETHANE)
	32760	ETHYL MERCAPTAN (ETHANETHIOL)
	32840	N-ETHYL MORPHOLINE
	32925	ETHYL POLYSILICATE
	80173	ETHYL PROPIONATE
	32940	ETHYL SILICATE (TETRAETHYL-o-SILICATE)
	92330	EXPLOSIVE
	92355	FABRIC
	92340	FABRIC FINISHER
	92345	FABRIC MODIFIER
	92350	FABRIC PLASTICIZER
	33085	FABRIC SOFTENER
	33115	FELDSPAR
	16280	FERBAM
FECL2	33160	FERRIC CHLORIDE
	33165	FERRIC SULFATE
	33230	FERROUS SULFATE
FEV	33235	FERROVANADIUM
	92360	FERTILIZER-CHEMICAL
	92365	FERTILIZER-ORGANIC
	80140	FIBER BOARD
	33245	FIBERGLASS
	90810	FIBERGLASS FABRIC
	90820	FIBERGLASS INSULATION
	80022	FILLER COMPOUND
	80023	FILTER MEDIA
	92370	FIRE EXTINGUISHER
	80001	FIRE RETARDANT
	92380	FLATTING AGENT
	92390	FLAVORING AGENT
	90800	FLINT
	33305	FLOOR WAX
	92400	FLOTATION AGENT
	33307	FLOUR
	90840	FLUORIDES
F	33370	FLUORINE
	90830	FLUORINE COMPOUNDS

Mnemonic Code	Code	Name
	33415	FLUOROBORIC ACID
TCFM	33565	FLUOROTRICHLOROMETHANE (FREON 11, TRICHLOROFLUOROMETHA
CAF2	33595	FLUORSPAR
	92410	FLUX
	92420	FOOD ADDITIVE
	92425	FOOD PRESERVATIVE
FDS	33635	FOODSTUFF
FDST	33637	FOODSTUFF-THERMAL DECOMPOSITION OF
HCHO	33640	FORMALDEHYDE (METHANAL, FORMALIN)
HCHO	33640	FORMALIN (METHANAL, FORMALDEHYDE)
	33675	FORMAMINE (HEXAMETHYLENETETRAMINE; HEXAMINE; METHENAMINE; UROTROPIN)
	90850	FORMATES
HCOOH	33720	FORMIC ACID
	32610	FORMIC ETHER (ETHYL FORMATE)
	33895	FOUNTAIN SOLUTION
	90860	FREON
TCFM	33565	FREON 11 (FLUOROTRICHLOROMETHANE, TRICHLOROFLUOROMETHANE)
DCDFM	24095	FREON 12 (DICHLORODIFLUOROMETHANE)
	24235	FREON 21 (DICHLOROMONOFLUOROMETHANE)
	71447	FREON 112
	74337	FREON 113 (TRIFLUOROTRICHLOROETHANE)
	92430	FUEL
	90870	FULLER'S EARTH
	92440	FUMIGANT
	92450	FUNGICIDE
	34185	FURAN
FUR	34120	FURFURAL (2-FURANCARBONAL; 2-FURALDEHYDE; FURAL; FURALE)
	34370	FURFURYL ALCOHOL
	34455	FURNITURE POLISH
	34585	GALLIUM
	69775	GALVANIZED STEEL
GN	90883	GASOLINE-LEAD CONTENT UNKNOWN
GL	90880	GASOLINE-LEADED
GU	90885	GASOLINE-UNLEADED (WHITE GAS)
	34715	GELATIN
GE	34770	GERMANIUM
	90890	GERMANIUM COMPOUNDS
GEOX	34792	GERMANIUM, OXIDES OF
	34815	GERMICIDE
	90900	GLASS
	76622	GLASS CLEANER (WINDOW CLEANER)
	90910	GLASS WOOL
	80024	GLAZING COMPOUND
	34892	GLAZE
	90920	GLUE-EPOXY BASE
	90925	GLUE-GUM
	92460	GLUE-OTHER
	90930	GLUE-RUBBER BASE
G	35085	GLYCERIN (GLYCERINE; GLYCEROL; 1, 2, 3-PROPANETRIOL)
G	35085	GLYCERINE (GLYCEROL; GLYCERIN; 1, 2, 2-PROPANETRIOL)
G	35085	GLYCEROL (GLYCERINE; GLYCERIN; 1, 2, 3-PROPANETRIOL)
	35120	GLYCIDOL (2, 3-EPOXY-1-PROPANOL)
	90950	GLYCOLS
AU	35455	GOLD

Mnemonic Code	Code	Name
AUOX	35457	GOLD, OXIDES OF
	90960	GOLD PLATING COMPOUND
C	17366	GRAPHITE (PLUMBAGO)
	35505	GRAVEL
	92470	GREASE
	92473	GREASE REMOVER
	80005	GRINDING COMPOUND
GWD	35507	GRINDING WHEEL DUST
	80049	GUM ARABIC
	35745	GUNK
	35750	GUTHION (AZINPHOS, METHYL)
	90980	GYPSUM
HF	35755	HAFNIUM
	92475	HAIR SPRAY
	92480	HAIR TONIC
	91000	HALIDES
	91010	HALOGENATED HYDROCARBON INSECTICIDES
	91030	HALOGENATED HYDROCARBONS
	92490	HARDENER
HE	35925	HELIUM
	35927	HEMATITE (IRON OXIDE, RED)
	80134	HEMP
	35960	HEPTACHLOR
HEP	36060	HEPTANE (DIPROPYL METHANE; HEPTYL HYDRIDE)
	36340	2-HEPTANONE (METHYL (n-AMYL) KETONE)
EBK	36330	3-HEPTANONE (ETHYL BUTYL KETONE)
HEP	36060	HEPTYL HYDRIDE (HEPTANE; DIPROPYL METHANE)
	91040	HETEROCYCLIC NITROGEN COMPOUNDS
	17385	HEXACHLOROETHANE (PERCHLOROETHANE; CARBON TRICHLORIDE; CARBON HEXACHLORIDE)
	36690	HEXACHLORONAPHTHALENE
	36710	HEXACHLOROPHENE
	21560	HEXAHYDROPHENOL (CYCLOHEXANOL)
	33675	HEXAMETHYLENETETRAMINE (FORMAMINE; HEXAMINE; METHENAMINE; UROTROPIN)
	33675	HEXAMINE (HEXAMETHYLENETETRAMINE; FORMAMINE; METHENAMINE; UROTROPIN)
HEX	36955	HEXANE (n-HEXANE)
HEX	36955	n-HEXANE (HEXANE)
MBK	37330	2-HEXANONE (METHYL BUTYL KETONE; METHYL n-BUTYL KETONE)
MIK	37510	HEXONE (METHYL ISOBUTYL KETONE)
	37520	sec-HEXYL ACETATE (METHYL AMYL ACETATE)
CAOH2	15743	HYDRATED LIME (CALCIUM HYDROXIDE; SLAKED LIME)
	38110	HYDRAZINE (DIAMINE; 1, 1-DIMETHYLHYDRAZINE)
	91050	HYDRAZINE SALTS
HBR	38575	HYDROBROMIC ACID (HYDROGEN BROMIDE)
	91060	HYDROCARBON PARAFFINS
	91070	HYDROCARBONS
HCL	38580	HYDROCHLORIC ACID (MURIATIC ACID, HYDROGEN CHLORIDE)
HCN	38530	HYDROCYANIC ACID (HYDROGEN CYANIDE; PRUSSIC ACID)
HFA	38550	HYDROFLUORIC ACID (HYDROGEN FLUORIDE)
H2	38585	HYDROGEN
HBR	38575	HYDROGEN BROMIDE (HYDROBROMIC ACID)
HCL	38580	HYDROGEN CHLORIDE (HYDROCHLORIC ACID, MURIATIC ACID)
HCN	38530	HYDROGEN CYANIDE (HYDROCYANIC ACID; PRUSSIC ACID)

Mnemonic Code	Code	Name
HFA	38550	HYDROGEN FLUORIDE (HYDROFLUORIC ACID)
H202	38605	HYDROGEN PEROXIDE
H2SE	38610	HYDROGEN SELENIDE
H2S	38620	HYDROGEN SULFIDE
	36645	HYDROQUINOL (HYDROQUINONE; QUINOL; p-DIHYDROXYBENZENE; 1, 4-BENZENEDIOL)
	36645	HYDROQUINONE (1, 4-BENZENEDIOL; p-DIHYDROXYBENZENE; HYDROQUINOL; QUINOL)
	38950	HYDROXYLAMINE HYDROCHLORIDE (HYDROXYLAMMONIUM CHLORIDE)
	38950	HYDROXYLAMMONIUM CHLORIDE (HYDROXYLAMINE HYDROCHLORIDE)
	38965	HYDROXYL ORGANIC COMPOUNDS
DAAL	23010	4-HYDROXY-4-METHYL-2-PENTANONE (DIACETONE ALCOHOL)
	91080	HYPOCHLORITES
	39365	ILLITE
	91085	IMIDES
	39820	INDENE
	80011	INDICATOR
IN	39860	INDIUM
	91090	INDIUM COMPOUNDS
	39995	INDUSTRIAL WASTE
	92520	INK
	92523	INK DRIER
	92760	INK, PRINTING
	92525	INK REMOVER
	92530	INK SOLVENT
	92545	INSECTICIDE
	92540	INSECT REPELLENT
	92550	INSULATION
	92553	INTENSIFIER
	40025	IODIDES
I	40030	IODINE
FE	91095	IRON
FEOX	40297	IRON, OXIDES OF
FE203	40298	IRON OXIDE ORE (MAGNETITE)
	35927	IRON OXIDE, RED (HEMATITE)
	91100	IRON SALTS-SOLUBLE
	40370	ISOAMYL ACETATE (BANANA OIL)
	40380	ISOAMYL ALCOHOL (3-METHYL-1-BUTANOL; ISOBUTYL CARBINOL)
	40410	ISOBUTYL ACETATE
	40430	ISOBUTYL ALCOHOL
	40380	ISOBUTYL CARBINOL (3-METHYL-1-BUTANOL; ISOAMYL ALCOHOL)
	40595	ISOCYANATES
	40910	ISOPHORONE
ISO	40940	ISOPRENE (3-METHYL-1, 3-BUTADIENE)
IPAL	40987	ISOPROPANOL (ISOPROPYL ALCOHOL)
	40982	2-ISOPROPOXYPROPANE
	40984	ISOPROPYL ACETATE
IPAL	40987	ISOPROPYL ALCOHOL (ISOPROPANOL)
	40990	ISOPROPYL AMINE
	25905	ISOPROPYL ETHER (DIISOPROPYL ETHER)
IGE	41150	ISOPROPYLGLYCIDYL ETHER
	91110	JET FUEL
	41775	KAOLIN
	41776	KAOLINITE
	91115	KEROSENE (OIL, FUEL NO. 1)

Mnemonic Code	Code	Name
	41840	KETENE
	21660	KETOHEXAMETHYLENE (CYCLOHEXANONE)
	91120	KETONES
	42035	KRYPTON
	92555	LACQUER
	42355	LACQUER THINNER
	91140	LACTONES
	80051	LANOLIN
	91150	LATEX
	80008	LAUNDRY ADDITIVE
	42405	LAYOUT FLUID
PB	42490	LEAD
	42510	LEAD ARSENATE
	91160	LEAD COMPOUNDS
	42600	LEAD FLUOROBORATE
PB304	42680	LEAD OXIDE
PBOX	42685	LEAD, OXIDES OF
	42805	LEATHER
	92560	LEAVENING AGENT
CAOH2	15743	LIME, SLAKED (HYDRATED LIME; CALCIUM HYDROXIDE)
CAO	15755	LIME, UNSLAKED (CALX; CALCIUM OXIDE; QUICKLIME; BURNT LIME)
CACO3	15705	LIMESTONE (CALCIUM CARBONATE)
	43025	LIMONITE
	09318	LINDANE (BENZENE HEXACHLORIDE)
	80053	LINSEED OIL
LPG	91190	LIQUID PETROLEUM GAS
LIH	43115	LITHIUM HYDRIDE
	92570	LUBRICANT
	43195	LUCITE
NAOH	69070	LYE (SODIUM HYDROXIDE; CAUSTIC SODA)
	43315	LYSOL
	92580	MACHINE COOLANT
MG	43320	MAGNESIUM
	80144	MAGNESIUM CARBONATE
MGCL2	43360	MAGNESIUM CHLORIDE
MGOX	43390	MAGNESIUM, OXIDES OF
FE203	40298	MAGNETITE (IRON OXIDE ORE)
	43470	MALATHION
MAH	43660	MALEIC ANHYDRIDE
MN	44000	MANGANESE
	44025	MANGANESE COMPOUNDS
MNO2	44030	MANGANESE DIOXIDE
MNOX	44035	MANGANESE, OXIDES OF
	44105	MASONITE
	92590	MEDICINE
	44840	MERCUROCHROME
HG	44870	MERCURY
	44915	MERCURY COMPOUNDS
HGOX	45315	MERCURY, OXIDES OF
	80156	MERTHIOLATE
	45360	MESITYL OXIDE
	92600	METAL
	80054	METAL DEFECT DETECTOR
	45385	METAL FINISH

Mnemonic Code	Code	Name
	80113	METAL SURFACE TREATMENT
HCHO	33640	METHANAL (FORMALIN; FORMALDEHYDE)
CH4	45655	METHANE
CH3HS	45850	METHANETHIOL (METHYL MERCAPTAN)
MEOH	45930	METHANOL (METHYL ALCOHOL)
	33675	METHENAMINE (FORMAMINE; HEXAMETHYLENETETRAMINE; HEXAMINE; UROTROPIN)
	46210	METHOXYCHLOR
	46240	2-METHOXYETHANOL
	46410	METHYL ACETATE
	46435	METHYLACETYLENE (PROPYNE)
	46450	METHYL ACRYLATE
	26075	METHYLAL (DIMETHOXYMETHANE)
MEOH	45930	METHYL ALCOHOL (METHANOL)
MENH2	46470	METHYLAMINE
	37520	METHYL AMYL ACETATE (sec-HEXYL ACETATE)
	46620	METHYL AMYL ALCOHOL
	36340	METHYL (n-AMYL) KETONE (2-HEPTANONE)
MEBR	46890	METHYL BROMIDE
ISO	40940	3-METHYL-1, 3-BUTADIENE (ISOPRENE)
	40380	3-METHYL-1-BUTANOL (ISOBUTYL CARBINOL; ISOAMYL ALCOHOL)
MBK	37330	METHYL BUTYL KETONE (METHYL n-BUTYL KETONE, 2-HEXANONE)
	32470	METHYL CELLOSOLVE (ETHYLENE GLYCOL MONOMETHYL ETHER)
	46935	METHYLCELLOSOLVE ACETATE (ETHYLENE GLYCOL MONOMETHYL ETHER ACETATE)
MCL	45770	METHYL CHLORIDE
TRIC	73760	METHYL CHLOROFORM (1, 1, 1-TRICHLOROETHANE)
	47030	METHYLCYCLOHEXANE
	47040	METHYLCYCLOHEXANOL
	47045	o-METHYLCYCLOHEXANONE
MDI	27780	METHYLENE BISPHENYL ISOCYANATE (DIPHENYL METHANE DIISOCYANATE)
MECL2	47270	METHYLENE CHLORIDE (DICHLOROMETHANE)
MEK	13980	METHYL ETHYL KETONE (2-BUTANONE)
MEKP	80105	METHYL ETHYL KETONE PEROXIDE
	33850	METHYL FORMATE
	47410	3-METHYL-5-HEPTANONE
	45655	METHYL HYDRIDE (METHANE)
	80055	METHYL p-HYDROXY BENZOATE
	47600	METHYL IODIDE
	47605	METHYL ISOAMYL KETONE
	47610	METHYL ISOBUTYL CARBINOL
MIK	37510	METHYL ISOBUTYL KETONE (HEXONE)
	47625	METHYL ISOCYANATE
	45850	METHYL MERCAPTAN (METHANETHIOL)
	47700	METHYL METHACRYLATE
	80155	METHYL ORANGE
	47855	METHYL PARATHION
MIK	37510	4-METHYL-2-PENTANONE
	54480	METHYL PROPYL KETONE (2-PENTANONE)
	80154	METHYL RED
	48330	METHYL SILICATE
	76510	alpha-METHYL STYRENE (VINYL TOLUENE)
	71900	METHYL TUADS (TETRAMETHYLTHIURAM DISULFIDE; THIRAM)
	17340	MEVINPHOS
	48535	MICA

Mnemonic Code	Code	Name
	48545	MINERAL SPIRITS
	48615	MOISTURIZER
	92610	MOLD RELEASE
	48625	MOLYBDENUM
MOS2	80056	MOLYBDENUM DISULFIDE
MOX	48628	MOLYBDENUM, OXIDES OF
	48655	MONEL STEEL
MONEO	48656	MONEL STEEL, OXIDES OF
	18190	MONOCHLOROBENZENE (CHLOROBENZENE)
EAM	04980	MONOETHANOLAMINE (ETHANOLAMINE)
	48780	MONOMETHYLANILINE
	48800	MONOMETHYLHYDRAZINE
	92620	MORDANT
	48910	MORPHOLINE
HCL	38580	MURIATIC ACID (HYDROCHLORIC ACID, HYDROGEN CHLORIDE)
	49580	NAPHTHA-COAL TAR
NAPH	49600	NAPHTHALENE
	90520	NAPHTHALENES, CHLORINATED
PD	49582	NAPHTHA-PETROLEUM (PETROLEUM DISTILLATES)
ANTU	07440	alpha-NAPHTHA THIUREA
	50065	beta-NAPHTHYLAMINE
	47800	1-NAPHTHYL-n-METHYL CARBAMATE (CARBARYL; SEVIN)
NG	50195	NATURAL GAS
	50315	NEON
NI	50420	NICKEL
	50430	NICKEL CARBONYLS
	50440	NICKEL CHLORIDE
NIOX	50495	NICKEL, OXIDES OF
	50510	NICKEL SULFATE
	50570	NICOTINE
	50675	NI-HARD STEEL
	50676	NI-HARD STEEL, OXIDES OF
	19985	NIOBIUM (COLUMBIUM)
HNO3	50742	NITRIC ACID
	50745	NITRIC OXIDE
	50058	NITRILO TRIACETIC ACID
	50748	p-NITROANILINE
	50760	NITROBENZENE
	17685	NITROCELLULOSE (CELLULOSE NITRATE)
	50775	p-NITROCHLOROBENZENE
	50783	NITRODIMETHYL AMINE
	50785	NITRO-DIPHENYL
	50795	NITROETHANE
N2	50865	NITROGEN
NO2	50870	NITROGEN DIOXIDE
NOX	50875	NITROGEN, OXIDES OF
	50883	NITROGEN PENTOXIDE
NO2	50873	NITROGEN TETROXIDE
	50885	NITROGEN TRIFLUORIDE
	50888	NITROGEN TRIOXIDE
	50890	NITROGLYCERINE (TRINITROGLYCERIN)
	50910	NITROMETHANE
	50930	m-NITROPHENOL
	50950	o-NITROPHENOL
	50940	p-NITROPHENOL

Mnemonic Code	Code	Name
	51100	1-NITROPROPANE
	51090	2-NITROPROPANE
	51110	n-NITROSODIMETHYLAMINE
	51115	NITROTOLUENE
	18710	NITROTRICHLOROMETHANE (CHLOROPICRIN)
	51118	NITROUS OXIDE
	80031	NUTRIENT MEDIA
	80013	NYLON
	51585	OCTACHLORONAPHTHALENE
	51705	OCTANE
OILC	52131	OIL, CUTTING
OILF	80123	OIL, FUEL (GENERAL)
	91115	OIL, FUEL NO. 1 (KEROSENE)
	52132	OIL, FUEL NO. 2 (DIESEL FUEL)
	52133	OIL, FUEL NO. 3
	52134	OIL, FUEL NO. 4
	52135	OIL, FUEL NO. 5
	52136	OIL, FUEL NO. 6 (OIL, BUNKER C)
	52137	OIL, FUSEL
	92500	OIL, HYDRAULIC
	52138	OIL, LUBE
	52139	OIL, MINERAL
	52141	OIL, MOTOR
	04590	OIL, ONION (ALLYL PROPYL DISULFIDE)
	52142	OIL, OTHER
	52143	OIL, PENETRATING
	52144	OIL, QUENCH
	52145	OIL, VEGETABLE
	80096	OILS, ESSENTIAL
	52365	OSMIUM
	52370	OSMIUM TETROXIDE
	52480	OXALIC ACID
	53395	OXIDIZING AGENT
O2	53525	OXYGEN-GAS
LOX	53526	OXYGEN-LIQUID
	53530	OXYGEN DIFLUORIDE
O3	53590	OZONE
	92630	PAINT
DP-PA	92635	PAINT, DECOMPOSITION PRODUCTS OF
	92640	PAINT DRIER
	92645	PAINT REMOVER
	92650	PAINT THINNER
	53615	PALLADIUM
	80168	PALLADIUM, OXIDES OF
	94140	PAPER
	53815	PARAFFIN
	53900	PARAQUAT
	53920	PARATHION
	53975	PASTE
	54130	PENTABORANE
	54155	PENTACHLORONAPHTHALENE
	54160	PENTACHLOROPHENOL
	54185	PENTAERYTHERITOL
	54243	n-PENTANE
	54246	iso-PENTANE

Mnemonic Code	Code	Name
	54480	2-PENTANONE (METHYL PROPYL KETONE)
	17385	PERCHLOROETHANE (CARBON HEXACHLORIDE; CARBON TRICHLORIDE; HEXACHLOROETHANE)
PCE	54790	PERCHLOROETHYLENE (TETRACHLOROETHYLENE)
	54800	PERCHLOROMETHYL MERCAPTAN
	54810	PERCHLORYL FLUORIDE
	54835	PERMANGANATE
	92660	PESTICIDE
PD	49582	PETROLEUM DISTILLATES (NAPHTHA-PETROLEUM)
	80059	PETROLEUM SULFONATE
	18080	PHENACYLCHLORIDE (a-CHLOROACETOPHENONE)
PHEN	55460	PHENOL (CARBOLIC ACID)
PH	56240	PHENOLPHTHALEIN
	56950	p-PHENYLENEDIAMINE
	57210	PHENYL ETHER
	57240	PHENYLETHYLENE
PGE	57280	PHENYL GLYCIDYL ETHER
	57300	PHENYLHYDRAZINE
	57700	PHOSDRIN
COCL2	57710	PHOSGENE (CARBONYL CHLORIDE)
	80060	PHOSPHATE
	57740	PHOSPHINE
H3PO4	58520	PHOSPHORIC ACID
PW	59125	PHOSPHOROUS-WHITE
PY	59130	PHOSPHOROUS-YELLOW
	59160	PHOSPHOROUS PENTACHLORIDE
	59162	PHOSPHOROUS PENTASULFIDE
	59115	PHOSPHOROUS PENTOXIDE
	59166	PHOSPHOROUS TRICHLORIDE
	92670	PHOTOGRAPHIC CHEMICAL
	92675	PHOTOGRAPHIC DEVELOPER
	80117	PHOTOGRAPHIC FIXER
	59173	PHOTOGRAPHIC PLATE CLEANER
	59185	PHTHALIC ACID
PAH	59230	PHTHALIC ANHYDRIDE
	59450	PICRIC ACID (2, 4, 6-TRINITROPHENOL)
	59465	PIGMENT
	80061	PINE OIL
	80033	PIPE JOINT SEALER
	60110	PIVAL (2-PIVALYL-1, 3-INDANDIONE; PINDONE)
	60110	2-PIVALYL-1, 3-INDANDIONE (PIVAL; PINDONE)
	60110	PINDONE (2-PIVALYL-1, 3-INDANDIONE; PIVAL)
	80007	PLASTER
	60122	PLASTER OF PARIS
	60123	PLASTIC
	92680	PLASTIC BODY FILLER
	92685	PLASTICIZER
	92690	PLATING COMPOUND
	92700	PLATING SOLUTION
	60125	PLATINUM
	80166	PLATINUM, OXIDES OF
C	17366	PLUMBAGO (GRAPHITE)
	76626	PLYWOOD (WOOD-RESIN BONDED)
	92720	POLISH
	60215	POLONIUM

Mnemonic Code	Code	Name
	80062	POLYCARBONATE
	60242	POLYELECTROLYTE
	60244	POLYESTER
	60246	POLYETHYLENE
	80010	POLYETHER
	80063	POLYETHYLENE GLYCOL
	60248	POLYMER
	60275	POLYPROPYLENE
	60285	POLYSTYRENE
DP-TEF	60295	POLYTETRAFLUOROETHYLENE, DECOMPOSITION OF
	60297	POLYURETHANE
PVC	60298	POLYVINYL CHLORIDE
	60350	POTASH (POTASSIUM CARBONATE)
K	60315	POTASSIUM
	60350	POTASSIUM CARBONATE (POTASH)
KCN	60400	POTASSIUM CYANIDE
	80064	POTASSIUM DICHROMATE
KOH	60440	POTASSIUM HYDROXIDE (CAUSTIC POTASH)
	80065	POTASSIUM OXIDE
	60585	POZZOLITH
	60665	PRECIPITATING AGENT
	92740	PRESERVATIVE
	92750	PRIMER
	80097	PRINTING CHEMICAL
	92760	PRINTING INK
PR-ACS	80128	PRODUCTS OF ACID CORE SOLDER
PC-C	60711	PRODUCTS OF COMBUSTION-COAL OR COKE
PC-O	60712	PRODUCTS OF COMBUSTION-FUEL OIL
PC-GL	60713	PRODUCTS OF COMBUSTION-GASOLINE (LEADED)
PC-GN	60714	PRODUCTS OF COMBUSTION-GASOLINE (LEAD CONTENT UNKNOWN)
PC-GU	60715	PRODUCTS OF COMBUSTION-GASOLINE (UNLEADED)
C-GAS	60716	PRODUCTS OF COMBUSTION-GENERAL
	80089	PRODUCTS OF COMBUSTION-JET FUEL
PC-K	60717	PRODUCTS OF COMBUSTION-KEROSENE
PC-NG	60718	PRODUCTS OF COMBUSTION-NATURAL GAS
PC-P	60719	PRODUCTS OF COMBUSTION-PROPANE
PC-W	60721	PRODUCTS OF COMBUSTION-WOOD
PR-RCS	80172	PRODUCTS OF ROSIN CORE SOLDER
	26615	PROPANE (DIMETHYLMETHANE)
	35085	1, 2, 3-PROPANETRIOL (GLYCERINE; GLYCEROL; GLYCERIN)
	62000	PROPARGYL ALCOHOL
	62270	beta-PROPIOLACTONE
	63265	n-PROPYL ACETATE
	63280	n-PROPYL ALCOHOL
PL	63495	PROPYLENE
	63520	PROPYLENE DICHLORIDE
PLG	63525	PROPYLENE GLYCOL
	63540	PROPYLENE IMINE
PLO	63550	PROPYLENE OXIDE (1, 2-EPOXYPROPANE)
	63620	n-PROPYL NITRATE
	46435	PROPYNE (METHYLACETYLENE)
HCN	38530	PRUSSIC ACID (HYDROCYANIC ACID; HYDROGEN CYANIDE)
	92780	PUMICE
	92790	PUTTY
	65070	PYRETHRUM

Mnemonic Code	Code	Name
	65080	PYRIDINE
	66495	QUARTZ
CAO	15755	QUICKLIME (CALCIUM OXIDE; UNSLAKED LIME; CALX; BURNT LIME)
	36645	QUINOL (HYDROQUINONE; HYDROQUINOL; p-DIHYDROXYBENZENE)
	66950	QUINONE
	67163	RADIUM
	67165	RADON
	80014	RAYON
	80088	REAGENT
	92800	REDUCING AGENT
	92810	REFRIGERANT
	80021	REINFORCING MATERIAL
	92820	RESIN
	92830	RETARDER
RH	67405	RHODIUM
	92840	RODENTICIDE
	67525	RONNEL
	67528	ROOFING TAR
	67530	ROTENONE
ROUGE	67535	ROUGE
	67536	ROX
	13410	RUBBER, BUTADIENE
	13455	RUBBER, BUTADIENE STYRENE
	67537	RUBBER, NATURAL
	67538	RUBBER, NEOPRENE
	67539	RUBBER, OTHER
	67541	RUBIDIUM
	67555	RUSITE
	92855	RUST INHIBITOR
	92860	RUST REMOVER (ERUSTICATOR)
	67855	SALTS
	67857	SALT WATER-OCEAN
	67915	SAND
	67918	SAND, SILICA FREE
	67935	SANITIZER
	68105	SCANDIUM
	68205	SCRATCH REMOVER
	68208	SEACOAL
	92865	SEALANT
SE	68295	SELENIUM
	68340	SELENIUM HEXAFLUORIDE
	47800	SEVIN (CARBARYL; 1-NAPHTHYL-n-METHYL CARBAMATE)
	68505	SEWAGE, COMBINED-SANITARY SEWAGE PLUS URBAN RUNOFF
	68508	SEWAGE, SANITARY
	68509	SHALE
	68511	SHAMPOO
	68512	SHELLAC
SIO2	23305	SILICA, AMORPHOUS (SILICON DIOXIDE)
SIO2F	68645	SILICA, CRYSTALLINE, FREE
	68655	SILICA, GEL
	68657	SILICATE OF SODA (SODIUM SILICATE)
	68658	SILICATES
SI	68695	SILICON
SIC	17525	SILICON CARBIDE (CARBORUNDUM)
SIO2	23305	SILICON DIOXIDE (SILICA, AMORPHOUS)

Mnemonic Code	Code	Name
	68659	SILICONE
AG	68730	SILVER
	80142	SILVER NITRATE
AGOX	68748	SILVER, OXIDES OF
	92880	SIZING COMPOUND
CAOH2	15743	SLAKED LIME (CALCIUM HYDROXIDE; HYDRATED LIME)
	68763	SLATE
	68764	SLUDGE-SEWAGE TYPE
	68766	SOAP
	68768	SOAPSTONE
NACO3	68850	SODA ASH (SODIUM CARBONATE)
NA	68765	SODIUM
	80069	SODIUM BICARBONATE
	80071	SODIUM BISULFATE
NACO3	68850	SODIUM CARBONATE (SODA ASH)
NACLO	68870	SODIUM CHLORATE
NACL	68880	SODIUM CHLORIDE
NACRO	68900	SODIUM CHROMATE
	68905	SODIUM CITRATE
NACN	68950	SODIUM CYANIDE
	69040	SODIUM FLUOROACETATE
	69055	SODIUM HEXAMETAPHOSPHATE
NAOH	69070	SODIUM HYDROXIDE (CAUSTIC SODA; LYE)
NAOCL	69090	SODIUM HYPOCHLORITE (CLOROX)
	69375	SODIUM PROPIONATE
	80073	SODIUM METABORATE
	80079	SODIUM METASILICATE
	68657	SODIUM SILICATE (SILICATE OF SODA)
	69445	SODIUM STEARATE
	69460	SODIUM SULFIDE
NASO	69470	SODIUM SULFITE
	80153	SODIUM THIOSULFATE
	80075	SODIUM TRICHLOROPHENATE
	80076	SODIUM TRIPOLYPHOSPHATE
	92890	SOFTENER
	80032	SOIL
	92900	SOIL ADDITIVE
	69615	SOLID WASTE
	92910	SOLVENT
	80121	SOYA ALKYD RESIN
	69705	SPOT REMOVER
	92920	STABILIZER
SS	69715	STAINLESS STEEL
SSOX	69717	STAINLESS STEEL, OXIDES OF
	69713	STAIN, WOOD
	80077	STANNIC CHLORIDE
	69735	STANNOUS FLUORIDE
	69738	STARCH
	17475	STEEL (CARBON STEEL)
	80118	STEEL BLUE
	69775	STEEL, GALVANIZED
STOX	80124	STEEL, OXIDES OF
SBH3	69800	STIBINE (ANTIMONY HYDRIDE)
	69855	STODDARD SOLVENT
	80112	STRIPPING SOLUTION

Mnemonic Code	Code	Name
	69935	STRONTIUM
	70060	STRYCHNINE
STY	70130	STYRENE (VINYL BENZENE)
S	70845	SULFUR
SO2	70860	SULFUR DIOXIDE
	70865	SULFUR HEXAFLUORIDE
H2SO4	70870	SULFURIC ACID
	70900	SULFUR MONOCHLORIDE
	70940	SULFUR PENTAFLUORIDE
	70960	SULFURYL FLUORIDE
	70995	SURFACTANT
	80136	SWEEPING COMPOUND
	71025	SYNTHETIC FABRIC
	22840	SYSTOX (DEMETON)
	73900	2, 4, 5-T (2, 4, 5-TRICHLOROPHENOXYACETIC ACID)
	71055	TALC
	71058	TALCUM POWDER
TA	71095	TANTALUM
	71135	TAR
	71193	TEDION (2, 4, 5, 4-TETRACHLORODIPHENYL SULFONE)
	88705	TEFLON, DECOMPOSITION PRODUCTS OF
TE	71197	TELLURIUM
	71200	TELLURIUM HEXAFLUORIDE
	71306	m-TERPHENYL
	71308	o-TERPHENYL
	71310	p-TERPHENYL
	80078	TETRACETIC ACID
	71447	1, 1, 2, 2-TETRACHLORO-1, 2-DIFLUOROETHANE (FREON 112)
	71193	2, 4, 5, 4-TETRACHLORODIPHENYL SULFONE (TEDION)
	71460	1, 1, 2, 2-TETRACHLOROETHANE
PCE	54790	TETRACHLOROETHYLENE (PERCHLOROETHYLENE)
	17490	TETRACHLOROMETHANE (CARBON TETRACHLORIDE)
	71500	TETRACHLORONAPHTHALENE
TEDP	71610	TETRAETHYL DITHIOPYROPHOSPHATE
TEPB	71640	TETRAETHYL LEAD
	32940	TETRAETHYL-o-SILICATE (ETHYL SILICATE)
TEPP	71680	TETRAETHYL PYROPHOSPHATE
	71695	TETRAHYDROFURAN
TMPB	71860	TETRAMETHYL LEAD
	71880	TETRAMETHYL SUCCINONITRILE
	71900	TETRAMETHYLTHIURAMDISULFIDE (THIRAM; METHYL TUADS)
	71930	TETRANITRO METHANE
	72055	TETRYL (2, 4, 6-TRINITROPHENYLMETHYLNITRAMINE)
TH	72095	THALLIUM
THOX	72085	THALLIUM, OXIDES OF
	92930	THICKENER
	92940	THINNER
	28880	THIODAN (ENDOSULFAN)
	71900	THIRAM (METHYL TUADS; TETRAMETHYLTHIURAMDISULFIDE)
TH	72985	THORIUM
SN	73075	TIN
	73252	TIN FLUOROBORATE
SNOX	73253	TIN, OXIDES OF
TI	73255	TITANIUM
TIO2	73258	TITANIUM DIOXIDE

Mnemonic Code	Code	Name
TOL	73300	TOLUENE (TOLUOL)
TDI	73390	TOLUENE-2, 4-DIISOCYANATE
	73470	o-TOLUIDINE
TOL	73300	TOLUOL (TOLUENE)
	73495	TONER
	73500	TOXAPHENE (CHLORINATED CAMPHENE)
	73515	TRANSMISSION FLUID
	73525	TREMOLITE
	73730	TRIBUTYL PHOSPHATE
TRIC	73760	1, 1, 1-TRICHLOROETHANE (METHYL CHLOROFORM)
	73770	1, 1, 2-TRICHLOROETHANE
TCE	73790	TRICHLOROETHYLENE (ACETYLENE TRICHLORIDE)
TCFM	33565	TRICHLOROFLUOROMETHANE (FREON 11, FLUOROTRICHLOROMETHANE)
	18500	TRICHLOROMETHANE (CHLOROFORM)
	73870	TRICHLORONAPHTHALENE
	73900	2, 4, 5-TRICHLOROPHENOXYACETIC ACID (2, 4, 5-T)
	73960	1, 2, 3-TRICHLOROPROPANE
	74010	1, 1, 2-TRICHLORO-1, 2, 2-TRIFLUOROETHANE
	74617	TRIDYMITE
	74175	TRIETHYLAMINE
	74335	TRIFLUOROMONOBROMOMETHANE
	74337	TRIFLUOROTRICHLOROETHANE (FREON 113)
	74405	TRIMETHYL BENZENE
	50890	TRINITROGYLCERIN (NITROGLYCERIN)
	59450	2, 4, 6-TRINITROPHENOL (PICRIC ACID)
	72055	2, 4, 6-TRINITROPHENYLMETHYLNITRAMINE (TETRYL)
TNT	74550	TRINITROTOLUENE
	74600	TRIORTHOCRESYL PHOSPHATE
	74613	TRIOX
	74635	TRIPHENYL PHOSPHATE
	74655	TRIPOLI
TSP	74795	TRISODIUM PHOSPHATE
W	74980	TUNGSTEN
	74990	TURPENTINE
	92950	TYPE CLEANER
	75155	UNDERCOATING
UNCH	75158	UNIDENTIFIED CHEMICAL
CAO	15755	UNSLAKED LIME (CALX; QUICKLIME; BURNT LIME; CALCIUM OXIDE)
U	75205	URANIUM
	75265	URBAN RUNOFF
	75915	URETHANE COMPOUND
	76005	UROTROPIN (FORMAMINE; HEXAMETHYLENETETRAMINE; HEXAMINE; METHENAMINE)
V	76165	VANADIUM
V205	76210	VANADIUM PENTOXIDE
	92960	VARNISH
	92965	VARNISH, DECOMPOSITION PRODUCTS OF
	92970	VARNISH DRYER
	76275	VARSOL
	94205	VEGETABLE PRODUCTS, NEC
	94215	VEHICLE, PAINT
	76355	VERMICULITE
VA	76420	VINYL ACETATE
STY	70130	VINYL BENZENE (STYRENE)
VCL	76445	VINYL CHLORIDE

Mnemonic Code	Code	Name
	76448	VINYL COMPOUNDS
	03800	VINYL CYANIDE (ACRYLONITRILE)
	80000	VINYL PLASTIC
	76510	VINYL TOLUENE (alpha-METHYL STYRENE)
	76605	VITHANE
	76610	WARFARIN
WHC	76612	WATERLESS HAND CLEANER
	80029	WATERPROOFING AGENT
	76613	WATER SOFTENER
	80009	WATER TREATMENT COMPOUND
	76614	WAX
	76615	WAX REMOVER
WGASE	76616	WELDING GASES, ELECTRIC
CGAS	76617	WELDING GASES, GAS
WR	76618	WELDING RODS
	92980	WETTING AGENT
GU	90885	WHITE GAS (GASOLINE-UNLEADED)
	80003	WHITENING AGENT
	80129	WINDEX
	76622	WINDOW CLEANER (GLASS CLEANER)
	94220	WOOD
	76623	WOOD FILLER-PLASTIC WOOD TYPE
	92990	WOOD PRESERVATIVE
	76624	WOOD, PRESSED
	76626	WOOD, RESIN BONDED (PLYWOOD)
	76627	WOOD SEALER
	69713	WOOD STAIN
	93200	WOOL
	76715	XENON
	76720	XYLENE (XYLOL)
	76910	XYLIDINE (DIMETHYLAMINOBENZENE)
	76720	XYLOL(XYLENE)
Y	77055	YTTRIUM
ZN	77115	ZINC
ZNCL2	77150	ZINC CHLORIDE
	77155	ZINC CHROMATE
ZNO2	77190	ZINC OXIDE
ZNOX	77195	ZINC, OXIDES OF
	77215	ZINC STEARATE
	80141	ZIRCON
ZR	77265	ZIRCONIUM

APPENDIX C

Emission Characteristics of Selected Industries

To provide examples of some of the data bases used for determining emission characteristics, some typical retrievals and tables are shown in this Appendix for the following industries:

Part 1 - Organic Chemicals
Part 2 - Plastics
Part 3 - Lubrication and Hydraulic Fluids

The data listed herein are aggregated for the overall industries, except for some of the air emissions. Summary statistics are not available for stack parameters or other emission characteristics from the air data base. Thus, for general values of these characteristics, one would have to retrieve data for a number of individual plants and manually compute typical values.

In addition, sample retrievals have been acquired for the major monitoring data bases relevant to the methods presented in this report. These sample outputs, presented to help illustrate their applications and limitations, are compiled in the final section of this appendix, entitled:

Part 4 - Retrievals from Other Monitoring Data Bases

All sources of material exhibited in this appendix will be appropriately identified on each exhibit. In most cases, the source will be a data base discussed in the body of this report (Volume 2). For example, exhibit C.1-3 is a distribution map from the IFD data base. Access and descriptive information on IFD has already been covered in Section 6.3.3(2) and Appendix A. Other sources may refer to documents cited in the reference section (7) of this report.

Appendix C
Part 1 - Organic Chemicals Industry

Exhibit C.1-1. Organic Chemicals Industry - Water Discharges
Source: Bureau of Census 1980a Water (Use in Manufacturing)

Water Discharged, Treated and Untreated, by Point of Discharge, for Industry Groups and Industries: 1978–Con.

All figures in billions of gallons, except where noted.

SIC code	Industry group and industry	Water intake	Water discharged	Number of establishments-- Discharging to public sewers	Number of establishments-- Discharging exclusively to public sewers	Water treated by point of discharge: Total	Public utility sewer	Streams and rivers	Lakes and ponds	Bays and estuaries	Ocean	Ground (wells, spray, seepage)	Transferred to other users
28	CHEMICALS AND ALLIED PRODUCTS.	4 325.5	3 910.3	684	333	967.4	100.5	604.0	107.5	129.4	(D)	17.6	(D)
281	INDUSTRIAL INORGANIC CHEMICALS .	964.6	855.3	118	48	299.0	46.7	184.6	33.4	28.7	(D)	2.4	(D)
2812	ALKALIES AND CHLORINE.	175.8	177.0	9	1	129.6	(D)	93.6	(D)	(D)	-	(D)	(D)
2816	INORGANIC PIGMENTS	(D)	(D)	19	9	47.3	(D)	34.4	(D)	(D)	-	(D)	-
2819	INDUSTRIAL INORGANIC CHEM., NEC. .	653.8	595.9	70	24	121.9	44.8	56.5	7.2	8.7	(D)	1.9	(D)
282	PLASTICS MATERIALS, SYNTHETICS .	481.6	454.9	96	50	110.1	7.8	97.0	(D)	3.4	-	.9	(D)
2821	PLASTICS MATERIALS AND RESINS. . .	150.7	139.1	76	40	27.2	5.4	20.0	(D)	1.1	-	.2	(D)
2822	SYNTHETIC RUBBER	33.2	29.0	6	4	(D)	(D)	7.3	-	(D)	-	(D)	(D)
2823	CELLULOSIC MANMADE FIBERS.	109.0	103.9	1	-	(D)	-	35.8	-	-	-	(D)	-
2824	ORGANIC FIBERS, NONCELLULOSIC. . .	188.7	182.9	13	6	36.3	(D)	33.8	(D)	(D)	-	(D)	(D)
283	DRUGS.	90.1	87.2	98	61	28.8	5.8	6.3	(D)	(D)	-	(D)	(D)
2831	BIOLOGICAL PRODUCTS.	.3	.3	8	5	(D)	(D)	-	-	-	-	-	-
2833	MEDICINALS AND BOTANICALS.	55.2	52.2	17	10	(D)	(D)	(D)	-	(D)	-	(D)	(D)
2834	PHARMACEUTICAL PREPARATIONS. . . .	34.6	34.7	73	46	8.2	4.3	(D)	(D)	(D)	-	(D)	(D)
284	SOAPS, CLEANERS, TOILET GOODS. .	(D)	(D)	87	46	(D)	10.3	1.0	-	(D)	-	-	(Z)
2841	SOAP AND OTHER DETERGENTS.	17.5	16.8	38	19	3.3	.7	(D)	-	(D)	-	-	(D)
2842	POLISHES AND SANITATION GOODS. . .	1.3	(D)	10	6	(D)	(D)	-	-	-	-	-	-
2843	SURFACE ACTIVE AGENTS.	15.0	14.3	15	9	9.9	9.2	(D)	-	-	-	-	(D)
2844	TOILET PREPARATIONS.	.2	1.6	24	12	(D)	(D)	(D)	-	-	-	-	(D)
286	INDUSTRIAL ORGANIC CHEMICALS . .	2 150.6	1 996.3	151	67	422.9	25.0	249.7	(D)	66.2	(D)	12.3	2.0
2865	CYCLIC CRUDES AND INTERMEDIATES. .	(D)	(D)	50	26	(D)	(D)	(D)	-	33.6	(D)	(D)	(D)
2869	INDUSTRIAL ORGANIC CHEMICALS, NEC.	1 909.9	1 764.9	98	40	362.4	15.8	235.7	(D)	(D)	-	11.8	(D)
287	AGRICULTURAL CHEMICALS	301.6	233.3	22	7	74.9	.8	60.3	(D)	12.7	-	.7	(D)
2873	NITROGENOUS FERTILIZERS.	87.4	58.9	12	6	22.2	(D)	19.7	(D)	(D)	-	(D)	(D)
2874	PHOSPHATIC FERTILIZERS	190.7	158.4	4	1	44.9	(D)	34.5	-	(D)	-	.5	-
2879	AGRICULTURAL CHEMICALS, NEC. . . .	(D)	(D)	6	-	(D)	.1	(D)	(D)	(D)	-	(D)	-
289	MISCELLANEOUS CHEMICAL PRODUCTS.	188.7	137.3	80	36	17.5	3.5	5.1	7.5	(D)	-	.7	(D)
2891	ADHESIVES AND SEALANTS	4.1	3.9	21	11	.1	(D)	(D)	-	-	-	-	-
2895	CARBON BLACK	4.4	1.4	4	1	.7	(D)	(D)	(D)	-	-	(D)	-
2899	CHEMICAL PREPARATIONS, NEC	140.9	93.9	49	22	13.3	3.2	1.7	(D)	(D)	-	(D)	(D)

Water Discharged, Treated and Untreated, by Point of Discharge, for Industry Groups and Industries: 1978–Con.

All figures in billions of gallons.

SIC code	Industry group and industry	Water untreated by point of discharge: Total	Public utility sewer	Streams and rivers	Lakes and ponds	Bays and estuaries	Ocean	Ground (wells, spray, seepage)	Transferred to other users
28	CHEMICALS AND ALLIED PRODUCTS.	2 942.9	306.7	2 384.3	127.2	93.6	2.9	9.5	18.4
281	INDUSTRIAL INORGANIC CHEMICALS	556.3	5.8	432.9	96.9	9.7	(D)	(D)	3.2
2812	ALKALIES AND CHLORINE.	47.4	2.6	42.3	(D)	-	(D)	(D)	(D)
2816	INORGANIC PIGMENTS	(D)	(D)	(D)	-	(D)	(D)	(D)	(D)
2819	INDUSTRIAL INORGANIC CHEM., NEC.	474.0	2.5	374.3	81.7	(D)	(D)	1.4	2.2
282	PLASTICS MATERIALS, SYNTHETICS	344.8	4.7	324.1	(D)	(D)	-	1.8	9.5
2821	PLASTICS MATERIALS AND RESINS.	111.9	3.8	100.5	(D)	(D)	-	.4	.8
2822	SYNTHETIC RUBBER	(D)	(D)	(D)	-	-	-	(D)	(D)
2823	CELLULOSIC MANMADE FIBERS.	(D)	(D)	(D)	-	-	-	-	-
2824	ORGANIC FIBERS, NONCELLULOSIC.	146.6	.8	143.2	(D)	(D)	-	(D)	(D)
283	DRUGS.	58.1	7.7	26.6	5.8	(D)	-	(D)	.3
2831	BIOLOGICAL PRODUCTS.	(D)	.3	(Z)	(D)	-	-	(D)	-
2833	MEDICINALS AND BOTANICALS.	(D)	.8	12.6	(D)	(D)	-	-	(D)
2834	PHARMACEUTICAL PREPARATIONS.	26.2	6.7	14.0	(D)	-	-	.2	(D)
284	SOAPS, CLEANERS, TOILET GOODS.	20.4	6.8	6.5	(D)	5.0	(D)	.3	.1
2841	SOAP AND OTHER DETERGENTS.	13.5	4.8	2.0	(D)	5.0	-	(D)	(D)
2842	POLISHES AND SANITATION GOODS.	1.2	.5	(D)	-	-	-	(D)	(D)
2843	SURFACE ACTIVE AGENTS.	4.3	.9	(D)	-	-	-	-	-
2844	TOILET PREPARATIONS.	1.4	.6	.5	-	-	(D)	(D)	(Z)
286	INDUSTRIAL ORGANIC CHEMICALS	1 573.4	121.9	1 392.5	4.1	46.4	(D)	(D)	4.7
2865	CYCLIC CRUDES AND INTERMEDIATES.	(D)	113.0	(D)	-	(D)	-	(D)	(D)
2869	INDUSTRIAL ORGANIC CHEMICALS, NEC.	1 402.6	(D)	1 344.0	4.1	37.4	(D)	(D)	4.7
287	AGRICULTURAL CHEMICALS	158.4	.9	145.9	(D)	(D)	-	1.0	.5
2873	NITROGENOUS FERTILIZERS.	36.7	.9	26.8	(D)	(D)	-	.8	(D)
2874	PHOSPHATIC FERTILIZERS	113.5	(D)	111.0	-	(D)	-	(D)	(D)
2879	AGRICULTURAL CHEMICALS, NEC.	(D)	(D)	(D)	-	(D)	-	-	(D)
289	MISCELLANEOUS CHEMICAL PRODUCTS.	119.8	49.0	52.3	15.1	.8	-	2.5	.1
2891	ADHESIVES AND SEALANTS	3.9	(D)	.9	(D)	(D)	-	(D)	(D)
2895	CARBON BLACK	.7	(D)	(D)	(D)	-	-	(D)	-
2899	CHEMICAL PREPARATIONS, NEC	80.6	47.2	16.6	13.8	(D)	-	2.2	(D)

Note: Figures shown for industry groups (3-digit) and major industry groups (2-digit) include data for all component industries, whether or not separate figures are shown for individual industries in the group.

Industries which have been omitted from the table have total water discharge of less than .05 or have data being withheld to avoid disclosure.

- Represents zero. (D) Withheld to avoid disclosing operations of individual companies. N.E.C. Not elsewhere classified.

(Z) Less than 50 million gallons.

Exhibit C.1-1 (cont'd)

Water Discharged, Treated and Untreated. bv Last use, for Industry Groups and Industries: 1978–Con.

All figures in billion of gallons.

1977 code	Industry group and industry	Water intake	Water discharged								
			Total	Treated water by last use							
				Total	Process	Cooling and condensing			Sanitary service	Boiler feed	Other
						Steam electric power generation	Air conditioning	Other			
28	CHEMICALS AND ALLIED PRODUCTS	4 325.5	3 910.3	967.4	309.8	47.0	6.7	487.8	14.7	66.6	34.8
281	INDUSTRIAL INORGANIC CHEMICALS	964.6	855.3	299.0	79.6	44.5	2.7	118.4	2.9	35.0	15.8
2812	ALKALIES AND CHLORINE	175.8	177.0	129.6	31.0	(D)	(D)	52.6	.2	1.7	1.6
2816	INORGANIC PIGMENTS	(D)	(D)	47.3	19.4	-	(D)	24.5	(D)	1.4	2.3
2819	INDUSTRIAL INORGANIC CHEM., NEC	653.8	595.9	121.9	29.2	(D)	2.6	41.3	(D)	31.9	11.8
282	PLASTICS MATERIALS, SYNTHETICS	481.6	454.9	110.1	72.4	(D)	(D)	23.8	2.4	5.0	4.9
2821	PLASTICS MATERIALS AND RESINS	150.7	139.1	27.2	15.2	-	.2	5.5	.9	3.4	2.1
2822	SYNTHETIC RUBBER	33.2	29.0	(D)	6.8	(D)	.2	(D)	.2	.6	1.4
2823	CELLULOSIC MANMADE FIBERS	109.0	103.9	(D)	34.6	-	(D)	(D)	.2	(D)	(D)
2824	ORGANIC FIBERS, NONCELLULOSIC	188.7	182.9	36.3	15.9	(D)	(D)	16.2	1.1	.9	(D)
283	DRUGS	90.1	87.2	28.8	6.2	(D)	(D)	20.1	.5	1.4	.5
2831	BIOLOGICAL PRODUCTS	.3	.3	(D)	(D)	-	-	-	(Z)	-	-
2833	MEDICINALS AND BOTANICALS	55.2	52.2	(D)	4.1	-	(D)	15.2	.1	.9	.3
2834	PHARMACEUTICAL PREPARATIONS	34.6	34.7	8.2	(D)	(D)	(D)	4.9	.4	.5	.2
284	SOAPS, CLEANERS, TOILET GOODS	(D)	(D)	(D)	2.7	-	(D)	4.6	.1	5.3	.8
2841	SOAP AND OTHER DETERGENTS	17.5	16.8	3.3	.4	-	(D)	2.2	(Z)	(Z)	(D)
2842	POLISHES AND SANITATION GOODS	1.5	(D)	(D)	(D)	-	(D)	(D)	(D)	(D)	(D)
2843	SURFACE ACTIVE AGENTS	15.0	14.3	9.9	1.9	-	(D)	2.3	(D)	5.2	.4
2844	TOILET PREPARATIONS	(D)	1.6	.2	.1	-	(D)	(D)	(Z)	(Z)	(D)
286	INDUSTRIAL ORGANIC CHEMICALS	2 150.6	1 996.3	422.9	127.3	1.6	1.9	261.1	6.8	15.7	8.6
2865	CYCLIC CRUDES AND INTERMEDIATES	(D)	(D)	(D)	(D)	(D)	1.1	(D)	(D)	(D)	(D)
2869	INDUSTRIAL ORGANIC CHEMICALS, NEC	1 909.9	1 764.9	362.4	107.3	(D)	(D)	228.4	5.3	12.1	7.1
287	AGRICULTURAL CHEMICALS	301.6	233.3	74.9	11.6	(D)	(D)	53.7	1.1	4.1	2.9
2873	NITROGENOUS FERTILIZERS	87.4	58.9	22.2	2.0	(D)	(D)	14.1	.5	3.4	1.6
2874	PHOSPHATIC FERTILIZERS	190.7	158.4	44.9	5.7	(D)	(D)	36.6	.6	.6	(D)
2879	AGRICULTURAL CHEMICALS, NEC	(D)	(D)	(D)	3.9	-	(D)	2.9	.1	.2	(D)
289	MISCELLANEOUS CHEMICAL PRODUCTS	188.7	137.3	17.5	(D)	(D)	(D)	(D)	(D)	(D)	(D)
2891	ADHESIVES AND SEALANTS	4.1	3.9	.1	(Z)	-	-	(D)	(D)	(D)	(D)
2895	CARBON BLACK	4.4	1.4	.7	(D)	-	(D)	(D)	(D)	(D)	(D)
2899	CHEMICAL PREPARATIONS, NEC	140.9	93.9	13.3	5.0	(D)	(D)	5.8	.3	.3	1.0

Water Discharged, Treated and Untreated, by Last Use, for Industry Groups and Industries: 1978–Con.

All figures in billion of gallons.

1977 code	Industry group and industry	Water discharged--Con.							
		Untreated water by last use							
		Total	Process	Cooling and condensing			Sanitary service	Boiler feed	Other
				Steam electric power generation	Air conditioning	Other			
28	CHEMICALS AND ALLIED PRODUCTS	2 942.9	342.1	334.9	60.2	2 112.4	21.9	25.0	46.4
281	INDUSTRIAL INORGANIC CHEMICALS	556.3	19.4	43.3	.7	475.9	1.7	4.7	10.6
2812	ALKALIES AND CHLORINE	47.4	(D)	(D)	(D)	32.0	.6	(D)	(D)
2816	INORGANIC PIGMENTS	(D)	(D)	(D)	(D)	(D)	(D)	2.7	(D)
2819	INDUSTRIAL INORGANIC CHEM., NEC	474.0	13.3	37.5	(D)	416.7	.9	(D)	3.5
282	PLASTICS MATERIALS, SYNTHETICS	344.8	12.7	42.7	40.8	229.1	.9	5.5	13.1
2821	PLASTICS MATERIALS AND RESINS	111.9	2.6	(D)	(D)	93.1	.5	(D)	1.6
2822	SYNTHETIC RUBBER	(D)	(D)	-	-	(D)	(D)	-	(D)
2823	CELLULOSIC MANMADE FIBERS	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
2824	ORGANIC FIBERS, NONCELLULOSIC	146.6	4.2	26.6	32.8	70.5	.3	2.8	9.5
283	DRUGS	58.1	2.9	(D)	1.5	49.4	1.7	(D)	1.2
2831	BIOLOGICAL PRODUCTS	(D)	.1	-	(D)	.1	(Z)	(Z)	(D)
2833	MEDICINALS AND BOTANICALS	(D)	.3	(D)	(D)	29.1	.1	(D)	(D)
2834	PHARMACEUTICAL PREPARATIONS	26.2	2.5	(D)	(D)	20.2	1.6	.5	1.2
284	SOAPS, CLEANERS, TOILET GOODS	20.4	1.9	(D)	1.7	11.7	1.9	.7	(D)
2841	SOAP AND OTHER DETERGENTS	13.5	1.6	(D)	1.2	7.7	.3	.6	(D)
2842	POLISHES AND SANITATION GOODS	1.2	(D)	-	(D)	.2	.7	(Z)	(D)
2843	SURFACE ACTIVE AGENTS	4.3	(D)	-	(D)	3.2	.7	.1	(D)
2844	TOILET PREPARATIONS	1.4	.2	-	.3	.7	.2	(Z)	.1
286	INDUSTRIAL ORGANIC CHEMICALS	1 573.4	150.9	228.4	5.6	1 164.6	1.2	9.8	12.7
2865	CYCLIC CRUDES AND INTERMEDIATES	(D)	112.1	(D)	(D)	(D)	(D)	.5	1.8
2869	INDUSTRIAL ORGANIC CHEMICALS, NEC	1 402.6	(D)	(D)	4.3	1 110.7	1.0	9.3	10.9
287	AGRICULTURAL CHEMICALS	158.4	39.8	(D)	.3	99.4	(D)	2.1	6.3
2873	NITROGENOUS FERTILIZERS	36.7	.5	(D)	(D)	(D)	.1	(D)	.7
2874	PHOSPHATIC FERTILIZERS	113.5	(D)	(D)	(D)	64.0	(D)	1.7	(D)
2879	AGRICULTURAL CHEMICALS, NEC	(D)	(D)	-	(D)	(D)	(D)	(D)	(D)
289	MISCELLANEOUS CHEMICAL PRODUCTS	119.8	8.4	3.1	9.7	81.1	14.5	1.6	1.5
2891	ADHESIVES AND SEALANTS	3.9	(D)	(D)	(D)	(D)	(Z)	(D)	(D)
2895	CARBON BLACK	.7	(D)	-	-	(D)	(Z)	(D)	(D)
2899	CHEMICAL PREPARATIONS, NEC	80.6	4.4	(D)	(D)	60.7	14.7	.8	(D)

Note: Figures shown for industry groups (3-digit) and major industry groups (2-digit) include data for all component industries, whether or not separate figures are show for individual industries in the group.

Industries which have been omitted from the table have total water discharge of less than .05 or have data being withheld to avoid disclosure.

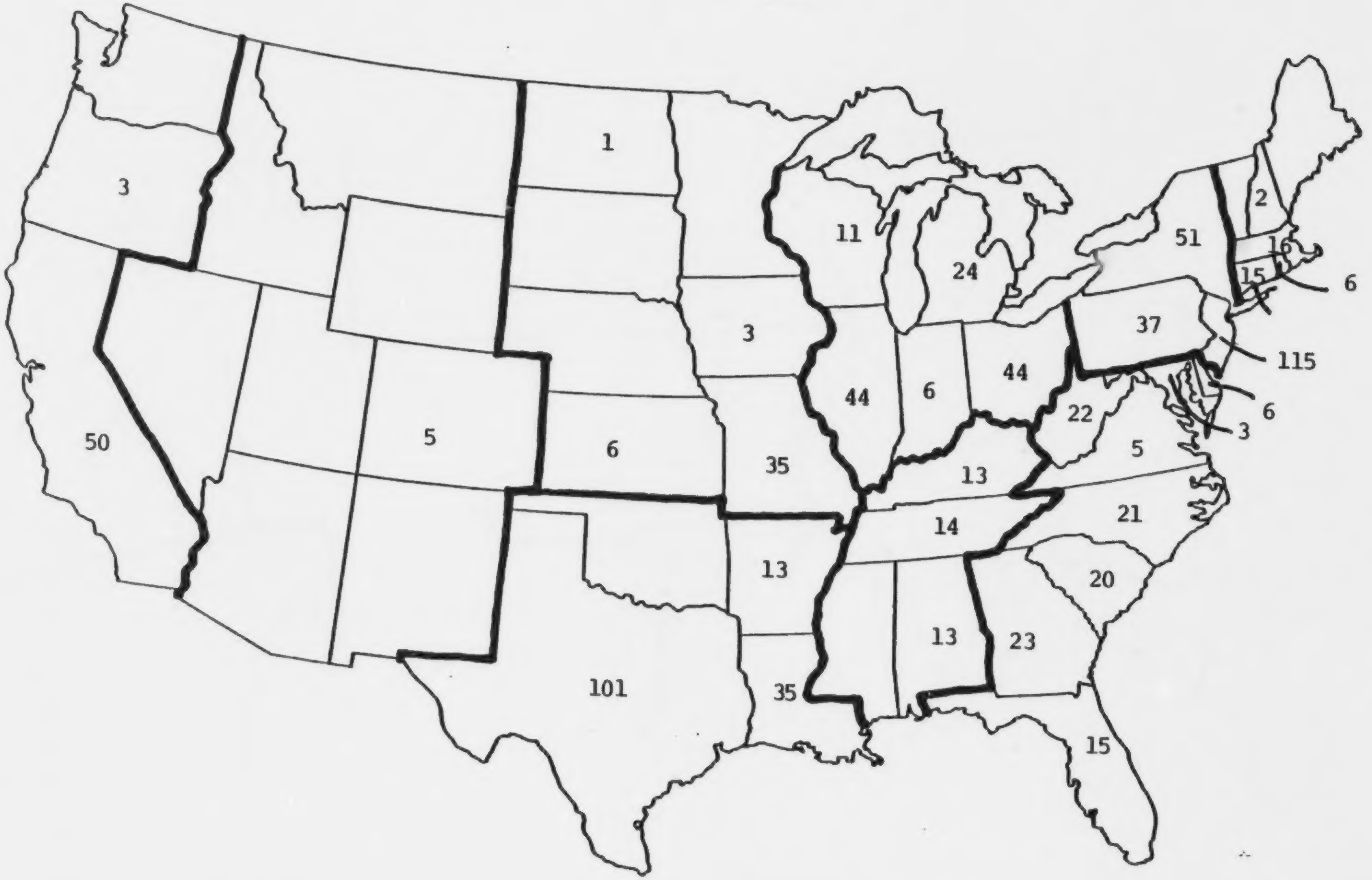
- Represents zero. (D) Withheld to avoid disclosing operations of individual companies. N.E.C. Not elsewhere classified.

(Z) Less than 50 million gallons.

Exhibit C.1-2. GEOGRAPHICAL DISTRIBUTION OF INDUSTRIAL FACILITIES

(Based on BoC Regions)

SIC Codes: 2861
2865
2869


1
3
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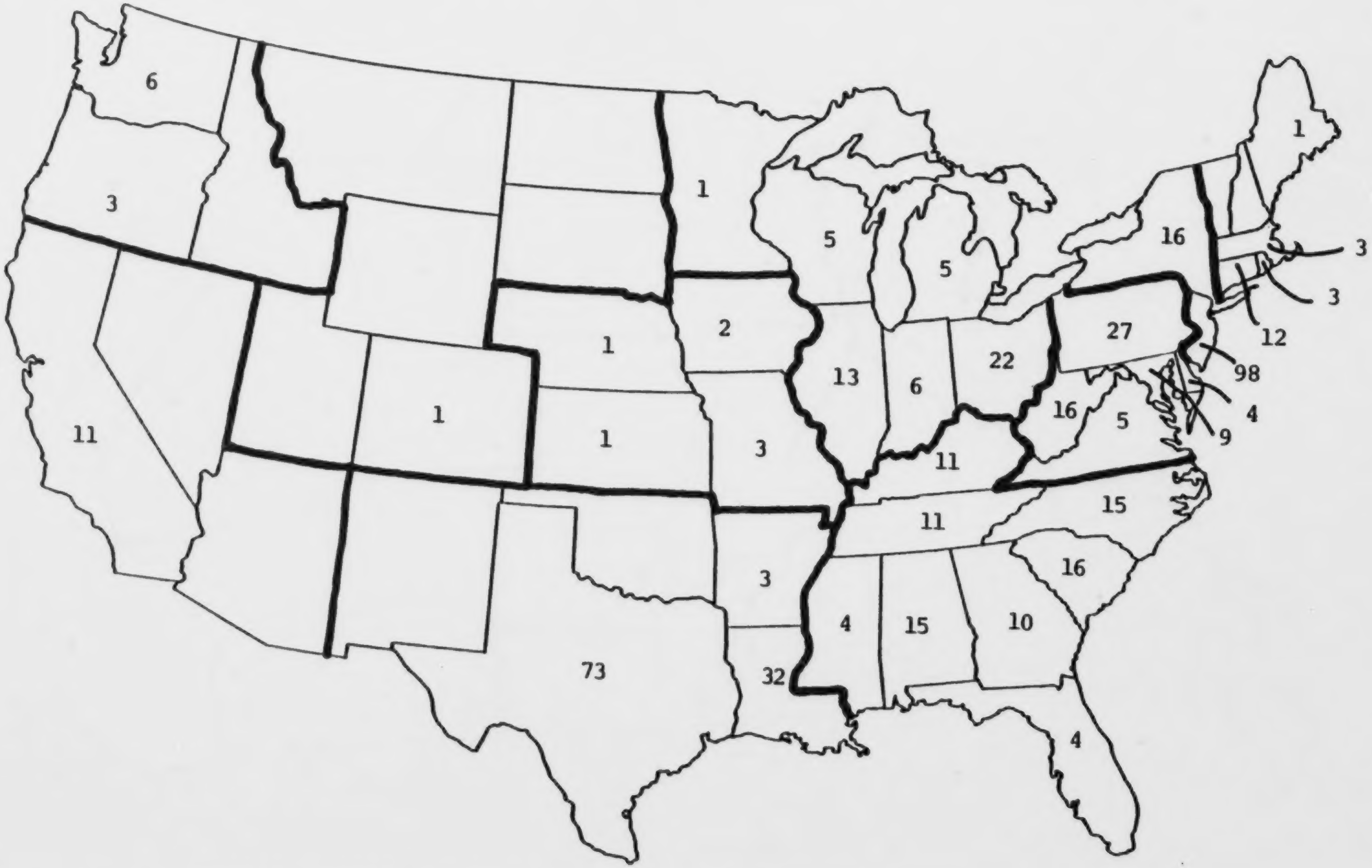
24
51
2
16
15
6
37
115
3
44
6
44
22
6
3
50
5
6
35
13
5
21
14
13
20
13
23
101
35
15

Source: Bureau of Census, 1980a. (1977 Census of Manufacturers, Industry Series MC77-I-28F, Industrial Organic Chemicals.)

Exhibit C.1-3. GEOGRAPHICAL DISTRIBUTION OF INDUSTRIAL FACILITIES

(Based on EPA Regions)

SIC Codes: 2865
2869


6
1
3
1
5
5
16
3
3
27
12
2
1
13
6
22
98
16
5
4
9
1
1
3
11
11
15
11
16
3
4
15
10
73
32
4

Source: Industrial Facilities Discharge Data Base (IFD)
EPA-OWRS/MDSD/WQAB.

9 - Puerto Rico

Exhibit C.1-4. Environmental Data Summary and Analysis for the Organic Chemicals Manufacturing Industry

Total number of plants: 2100

	1° organics	1° plastics	1° both	2° all
Number of direct dischargers:	254	205	42	581
Number of indirect dischargers:	284	116	32	103
Number of other dischargers:	117	236	37	93

Total flow:	2.94	BGD	1073.1	BGY
Total Direct Flow:	2.32	BGD	843.2	BGY
Total Indirect Flow:	0.63	BGD	229.9	BGY

Number of operating days per year: 365

SIC codes: 2821, 2823, 2824, 2865, 2869

Source: Versar, Inc. 1982. Prepared for EPA-OWRS/MDSD/WQAB.
Data supplied by EPA-OWRS/EGD.

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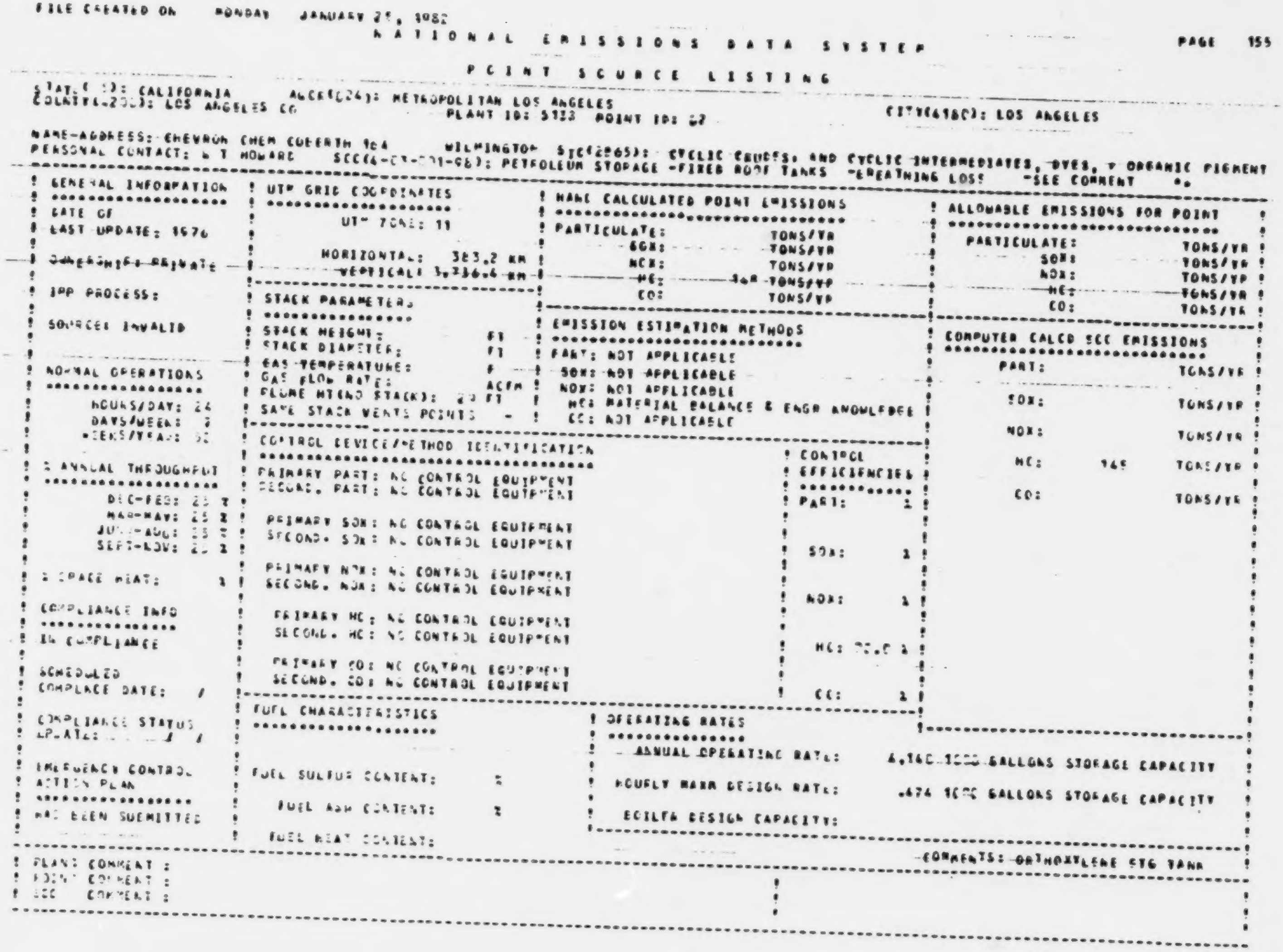
                               IFD        REPORT            01/22/82                          PAGE    23

  STATE: NC  ---------------- INDUSTRIAL FACILITIES IN THE I.F.D. DATABASE ------  VERBAR INCORPORATED
                                                                                 SPRINGFIELD, VIRGINIA 22151
=====================================================================================================================
****NPDES #   FACILITY NAME                        DISCHARGE FLOW  CNTY#  CITY#    COUNTY NAME       -----CITY NAME------
DOSN #       LAT/LONG        CODE  TYPE  PIPE#  SIC   **1000 GPD**  RCVG WTR                          CATALOG   UNIT  SEG#
=====================================================================================================================
****NC0004138 SO TEX CHEM MOUNT HOLLY           CATAWBA RV              071   52960  GASTON            MOUNT HOLLY
             0351715/0810020  S     R    0001   2865                93  CATAWBA R                         03-05-01-01    012
****NC0039128 FORSHAW CHEM-CHARLOTTE            UNKNOWN                 119   13920  MECKLENBURG       CHARLOTTE CITY
             0351300/0805000  S     P    0001   2865                 1  L SUGAR C                         03-05-01-03    031
****NC0027065 PFIZER INC-SOUTHPORT PLT          CAPE FEAR RV            019   72320  BRUNSWICK         SOUTHPORT TOWN
             0335610/0775917  S     R    0001   2865              2030  LW CAPE FEAR R                    03-03-00-05    005
****NC0005274 CROMPTON & KNOWLES CORP-LOWELL  SOUTH FORK CATAWBA R     071          GASTON
             0351700/0810620  S     P    0001   2865               300  SF CATAWBA R                      03-05-01-02    001
****NC0000663 DU PONT WILMINGTON                CAPE FEAR RV            019   10090  BRUNSWICK         ACME
             0341950/0780235  S     P    0002   2869              3500  CAPE FEAR R                       03-03-00-05    011
             0341905/0780140  S     C    0001   2869              2500  CAPE FEAR R                       03-03-00-05    011
****NC0040690 AM CYANAMID CO-CHARLOTTE          PAW CR                  119   13920  MECKLENBURG       CHARLOTTE CITY
             0351500/0805500  S     P    0001   2869               100  PAW C                             03-05-01-01    009
****NC0004375 MARTIN MARIETTA SODYECO CHARLT CATAWBA RV                 119          MECKLENBURG
             0351740/0810012  S     R    0001   2869              1680  CATAWBA R                         03-05-01-01    012
****NC0003514 SWIFT AGRIC CHEM WILMINGTON       CAPE FEAR RV            129   86800  NEW HANOVER       WILMINGTON CITY
             0341500/0775840  S     P    0002   2869              57.6  CAPE FEAR R                       03-03-00-05    010
             0341500/0775840  S     R    0001   2869              1150  CAPE FEAR R                       03-03-00-05    010
****NC0001112 HERCULES-WILMINGTON               CAPE FEAR RV            129   54990  NEW HANOVER       WILMINGTON
             0341810/0780040  S     P    0002   2869               362  CAPE FEAR R                       03-03-00-05    011
             0341850/0775830  S     C    0001   2869               480  NE CAPE FEAR R                    03-03-00-07    001
****NC0001082 NE CHEM WILMINGTON                CAPE FEAR RV            129   54990  NEW HANOVER       ALMONT
             0341600/0775600  S     C    0001   2869               .75  NE CAPE FEAR R                    03-03-00-07    001
****NC0000892 REICHHOLD CHEM MONCURE            HAW RV                  037   51680  CHATHAM           MONCURE TOWN
             0353555/0790308  S     P    0001   2869              83.4  HAW R                             03-03-00-02    001
****               UNIROYAL CHEMICAL DIVISION                           071   29120  GASTON            GASTONIA
NC0020184            /        M     P    0001   2869                68
****               STEIN HALL & CO, INC                                 119   13930  MECKLENBURG       CHARLOTTE
NC0024945            /        M     P    0001   2869               267
****               PROCTOR CHEM CO                                      159   68080  ROWAN             SALISBURY
NC0023892            /        M     P    0001   2869               191
****               CIBA GEIGY CORP                                      081   31920  GUILFORD          GREENSBORO
NC0023833            /        M     P    0001   2869                63
```

Exhibit C.1-5. Example of IFD Retrieval



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FILE CREATED ON    MONDAY   JANUARY 25, 1982
                        N A T I O N A L   E M I S S I O N S   D A T A   S Y S T E M                PAGE   155
                                        P O I N T   S O U R C E   L I S T I N G
STATE([illegible]): CALIFORNIA     AQCR(024): METROPOLITAN LOS ANGELES
COUNTY([illegible]): LOS ANGELES CO                PLANT ID: 5133  POINT ID: 02            CITY(4180): LOS ANGELES

NAME-ADDRESS: CHEVRON CHEM CO BERTH 164      WILMINGTON  SIC(2865): CYCLIC CRUDES, AND CYCLIC INTERMEDIATES, DYES, & ORGANIC PIGMENT
PERSONAL CONTACT: W T HOWARD    SCC(4-03-001-06): PETROLEUM STORAGE -FIXED ROOF TANKS  -BREATHING LOSS   -SEE COMMENT   *.
---------------------------------------------------------------------------------------------------------------------
! GENERAL INFORMATION  ! UTM GRID COORDINATES        ! NAME CALCULATED POINT EMISSIONS     ! ALLOWABLE EMISSIONS FOR POINT   !
! ******************** ! ********************        ! ******************************      ! ******************************  !
! DATE OF              !           UTM ZONE: 11      ! PARTICULATE:            TONS/YR     !  PARTICULATE:          TONS/YR  !
! LAST UPDATE: 1976    !                             !         SOX:            TONS/YR     !          SOX:          TONS/YR  !
!                      !      HORIZONTAL:  383.2 KM  !         NOX:            TONS/YR     !          NOX:          TONS/YR  !
! OWNERSHIP: PRIVATE   !      VERTICAL:  3,736.4 KM  !          HC:       148  TONS/YR     !           HC:          TONS/YR  !
!                      !-----------------------------!          CO:            TONS/YR     !           CO:          TONS/YR  !
! IPP PROCESS:         ! STACK PARAMETERS            !-------------------------------------!---------------------------------!
!                      ! ****************            ! EMISSION ESTIMATION METHODS         ! COMPUTER CALCD SCC EMISSIONS    !
! SOURCE: INVALID      ! STACK HEIGHT:           FT  ! ***************************         ! ****************************    !
!                      ! STACK DIAMETER:         FT  ! PART: NOT APPLICABLE                !     PART:              TONS/YR  !
! NORMAL OPERATIONS    ! GAS TEMPERATURE:        F   !  SOX: NOT APPLICABLE                !                                 !
! *****************    ! GAS FLOW RATE:        ACFM  !  NOX: NOT APPLICABLE                !      SOX:              TONS/YR  !
!      HOURS/DAY: 24   ! PLUME HT(NO STACK):  23 FT  !   HC: MATERIAL BALANCE & ENGR KNOWLEDGE !                           !
!      DAYS/WEEK:  7   ! SAME STACK VENTS POINTS  -  !   CO: NOT APPLICABLE                !      NOX:              TONS/YR  !
!     WEEKS/YEAR: 52   !---------------------------------------------------------------------!                             !
!                      ! CONTROL DEVICE/METHOD IDENTIFICATION                ! CONTROL       !       HC:      149   TONS/YR  !
! % ANNUAL THROUGHPUT  ! ************************************                ! EFFICIENCIES  !                                 !
! ******************** ! PRIMARY PART: NO CONTROL EQUIPMENT                  ! ************  !       CO:              TONS/YR  !
!        DEC-FEB: 25 % ! SECOND. PART: NO CONTROL EQUIPMENT                  ! PART:       % !                                 !
!        MAR-MAY: 25 % !                                                     !               !                                 !
!        JUN-AUG: 25 % !  PRIMARY SOX: NO CONTROL EQUIPMENT                  !               !                                 !
!       SEPT-NOV: 25 % !  SECOND. SOX: NO CONTROL EQUIPMENT                  !  SOX:       % !                                 !
!                      !                                                     !               !                                 !
! % SPACE HEAT:      % !  PRIMARY NOX: NO CONTROL EQUIPMENT                  !               !                                 !
!                      !  SECOND. NOX: NO CONTROL EQUIPMENT                  !  NOX:       % !                                 !
! COMPLIANCE INFO      !                                                     !               !                                 !
! ***************      !   PRIMARY HC: NO CONTROL EQUIPMENT                  !               !                                 !
! IN COMPLIANCE        !   SECOND. HC: NO CONTROL EQUIPMENT                  !  HC: [illegible] % !                            !
!                      !                                                     !               !                                 !
! SCHEDULED            !   PRIMARY CO: NO CONTROL EQUIPMENT                  !               !                                 !
! COMPLIANCE DATE:   / !   SECOND. CO: NO CONTROL EQUIPMENT                  !  CO:        % !                                 !
!                      !-------------------------------------------------------------------------!-----------------------------!
! COMPLIANCE STATUS    ! FUEL CHARACTERISTICS             ! OPERATING RATES                                                  !
! UPDATE:       /  /   ! ********************             ! ***************                                                  !
!                      !                                  !   ANNUAL OPERATING RATE:    4,160 1000 GALLONS STORAGE CAPACITY  !
! EMERGENCY CONTROL    ! FUEL SULFUR CONTENT:     %       !                                                                  !
! ACTION PLAN          !                                  !  HOURLY MAXM DESIGN RATE:    .474 1000 GALLONS STORAGE CAPACITY  !
! ****************     !   FUEL ASH CONTENT:      %       !                                                                  !
! HAS BEEN SUBMITTED   !                                  !   BOILER DESIGN CAPACITY:                                        !
!                      !  FUEL HEAT CONTENT:              !------------------------------------------------------------------!
---------------------------------------------------------------------------------------------------------------------
! PLANT COMMENT :                                                      -COMMENTS: ORTHOXYLENE STG TANK               !
! POINT COMMENT :                                      ------------------------------------------------------------------
! SCC   COMMENT :                                      !                                                             !
---------------------------------------------------------------------------------------------------------------------
```
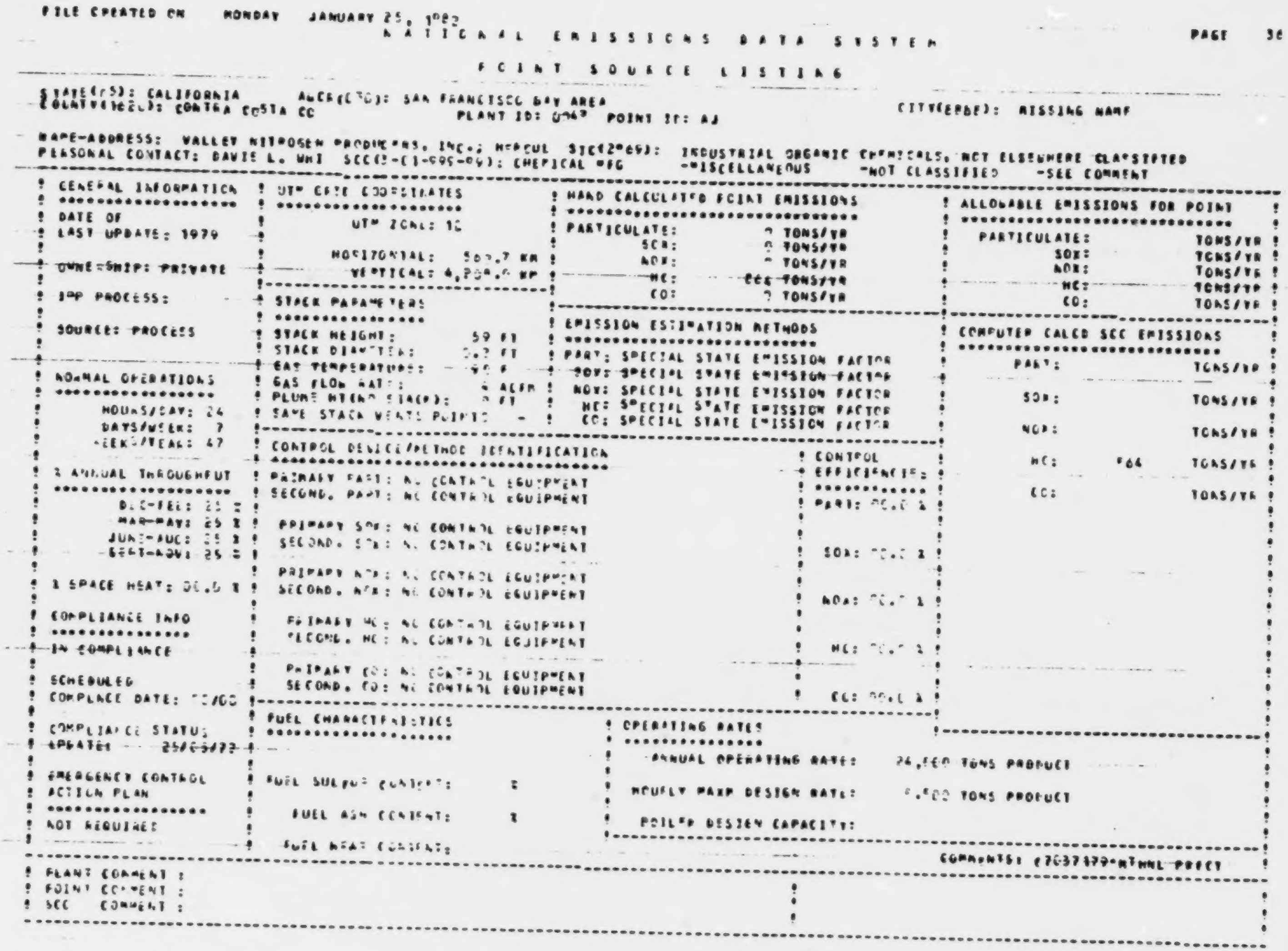

Exhibit C.1.6. Example of NEDS Retrieval



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FILE CREATED ON    MONDAY   JANUARY 25, 1982                                                                          PAGE   36
                                        N A T I O N A L   E M I S S I O N S   D A T A   S Y S T E M

                                                    P O I N T   S O U R C E   L I S T I N G

STATE(FS): CALIFORNIA        AQCR(CTG): SAN FRANCISCO BAY AREA
COUNTY(ICCD): CONTRA COSTA CC                      PLANT ID: 0047  POINT ID: AJ                 CITY(EPBF):  MISSING NAME

NAME-ADDRESS:  VALLEY NITROGEN PRODUCERS, INC.; HERCUL  SIC(2869):  INDUSTRIAL ORGANIC CHEMICALS, NOT ELSEWHERE CLASSIFIED
PERSONAL CONTACT: DAVIS L. WHI  SCC(3-01-999-99): CHEMICAL MFG      -MISCELLANEOUS     -NOT CLASSIFIED    -SEE COMMENT
----------------------------------------------------------------------------------------------------------------------------
! GENERAL INFORMATION  ! UTM GRID COORDINATES      ! HAND CALCULATED POINT EMISSIONS       ! ALLOWABLE EMISSIONS FOR POINT  !
! ******************** ! ********************      ! *****************************         ! ****************************** !
! DATE OF              !                           ! PARTICULATE:         0 TONS/YR        !   PARTICULATE:         TONS/YR !
! LAST UPDATE: 1979    !         UTM ZONE: 10      !         SOX:         0 TONS/YR        !           SOX:         TONS/YR !
!                      !                           !         NOX:         0 TONS/YR        !           NOX:         TONS/YR !
! OWNERSHIP: PRIVATE   !   HORIZONTAL:  582.7 KM   !          HC:       664 TONS/YR        !            HC:         TONS/YR !
!                      !     VERTICAL: 4,208.0 KM  !          CO:         0 TONS/YR        !            CO:         TONS/YR !
! IPP PROCESS:         !---------------------------!---------------------------------------!--------------------------------!
!                      ! STACK PARAMETERS          ! EMISSION ESTIMATION METHODS           ! COMPUTER CALCD SCC EMISSIONS   !
! SOURCE: PROCESS      ! ****************          ! ***************************           ! ****************************   !
!                      ! STACK HEIGHT:       59 FT ! PART: SPECIAL STATE EMISSION FACTOR   !       PART:            TONS/YR !
!                      ! STACK DIAMETER:    0.7 FT !  SOX: SPECIAL STATE EMISSION FACTOR   !                                !
!----------------------! GAS TEMPERATURE:     0 F  !  NOX: SPECIAL STATE EMISSION FACTOR   !        SOX:            TONS/YR !
! NORMAL OPERATIONS    ! GAS FLOW RATE:     0 ACFM !   HC: SPECIAL STATE EMISSION FACTOR   !                                !
! ******************   ! PLUME HT(NO STACK):  0 FT !   CO: SPECIAL STATE EMISSION FACTOR   !        NOX:            TONS/YR !
!     HOURS/DAY: 24    ! SAME STACK VENTS POINTS -  !---------------------------------------!                                !
!     DAYS/WEEK:  7    !---------------------------------------------------------------------!         HC:      664   TONS/YR !
!    WEEKS/YEAR: 47    ! CONTROL DEVICE/METHOD IDENTIFICATION             ! CONTROL            !                                !
!----------------------! ************************************             ! EFFICIENCIES:      !         CO:            TONS/YR !
! % ANNUAL THROUGHPUT  ! PRIMARY PART: NO CONTROL EQUIPMENT               ! ************       !                                !
! ******************** ! SECOND. PART: NO CONTROL EQUIPMENT               ! PART:  00.0 %      !                                !
!       DEC-FEB: 25 %  !                                                  !                    !                                !
!       MAR-MAY: 25 %  !  PRIMARY SOX: NO CONTROL EQUIPMENT               !                    !                                !
!       JUN-AUG: 25 %  !  SECOND. SOX: NO CONTROL EQUIPMENT               !  SOX:  00.0 %      !                                !
!      SEPT-NOV: 25 %  !                                                  !                    !                                !
!                      !  PRIMARY NOX: NO CONTROL EQUIPMENT               !                    !                                !
! % SPACE HEAT: 00.0 % !  SECOND. NOX: NO CONTROL EQUIPMENT               !  NOX:  00.0 %      !                                !
!                      !                                                  !                    !                                !
! COMPLIANCE INFO      !   PRIMARY HC: NO CONTROL EQUIPMENT               !                    !                                !
! ***************      !   SECOND. HC: NO CONTROL EQUIPMENT               !   HC:  00.0 %      !                                !
! IN COMPLIANCE        !                                                  !                    !                                !
!                      !   PRIMARY CO: NO CONTROL EQUIPMENT               !                    !                                !
! SCHEDULED            !   SECOND. CO: NO CONTROL EQUIPMENT               !   CO:  00.0 %      !                                !
! COMPLNCE DATE: 00/00 !--------------------------------------------------------------------------!                                !
!                      ! FUEL CHARACTERISTICS         ! OPERATING RATES                           !--------------------------------!
! COMPLIANCE STATUS    ! ********************         ! ***************                                                           !
! UPDATED     25/05/77 !                              !   ANNUAL OPERATING RATE:    24,000 TONS PRODUCT                           !
!                      !                              !                                                                           !
! EMERGENCY CONTROL    ! FUEL SULFUR CONTENT:     %   ! HOURLY MAXM DESIGN RATE:     0,000 TONS PRODUCT                           !
! ACTION PLAN          !                              !                                                                           !
! ***************      !   FUEL ASH CONTENT:      %   !  BOILER DESIGN CAPACITY:                                                  !
! NOT REQUIRED         !                              !---------------------------------------------------------------------------!
!                      !  FUEL HEAT CONTENT:          !                                                                           !
-------------------------------------------------------------------------------------- COMMENTS: 27037379-NTHNL PRECT             !
! PLANT COMMENT :                                                                                                                  !
! POINT COMMENT :                                              !                                                                   !
! SEC   COMMENT :                                              !                                                                   !
------------------------------------------------------------------------------------------------------------------------------------
```

Exhibit C.1.6.   Example of NEDS Retrieval (cont'd)

```
                                                                        PAGE   42
                                                              LATEST UPDATE: 820908
                                 ORGANIC CHEMICAL PRODUCERS DATA BASE

                                          PRODUCT DATA REPORT

 810  (P)    CARBON TETRACHLORIDE

     CAS REGISTRY NUMBER      56235
     WISWESSER LINE NOTATION: GXGGG
     NIOSH NUMBER FG49000

SYNONYMS
--------
     ENT 4,705
     HALON 104
     METHANE TETRACHLORIDE
     NECATORINE
     BENZINOFORM
     NECATORINA
     PERCHLOROMETHANE
     TETRACHLOROMETHANE
     FREON 10
     TETRAFINOL
     TETRAFORM
     CARBONA
     TETRASOL
     FLUKOIDS
     UNIVERM
     VERMOESTRICID
     CARBON CHLORIDE (CCL4)

ECONOMIC DATA
-------------
     YEAR    VOLUME (MMLBS/YR)     SALES (MM$/YR)  UNIT COST ($/LB)
      81                                                  .195
      80             709.080
      74            1162.660
      79
      76             850.000                 40.023         .140

USES                                 (FOR DERIVATION OF CHEMICALS AND ALLIED PRODUCTS)
----                                 -----------------------------------------------
                                                                      AMOUNT      % DOM.  IPPED        SIC
     GASOLINE                           PETROLEUM PRODUCT, REFINED   (MMLBS/YR)
                                             AS ADDITIVE                                               2911
     PESTICIDES                         PESTICIDE PREPARATION
     FLUOROCARBONS 11 AND 12            INDUSTRIAL ORGANIC CHEMICAL N.E.C.   770.000   95.000  16/1-8     2879
     AZEOTROPE DRYING AGENTS            CHEMICAL PREPARATION N.E.C.                                        2869
                                                                                                       2899
```

Exhibit C.1-7. Example of OCPDB Retrieval

```
                                                                PAGE   41
                                                          LATEST UPDATE: 820908
                              ORGANIC CHEMICAL PRODUCERS DATA BASE

                                     PRODUCT DATA REPORT


        ORGANIC CHEMICALS                        FOR WET SPARK PLUGS
                                             INDUSTRIAL ORGANIC CHEMICAL N.E.C.                         2869
                                                 AS SOLVENT
        FLOWER AND SEED OILS                 ESSENTIAL OILS                                             2899
                                                 AS EXTRACTANT

    USES                               (FOR OTHER COMMERCIAL/INDUSTRIAL APPLICATIONS)
    ----                               ----------------------------------------------
                                                                            AMOUNT     % DOM.    SIC
        AGRICULTURAL SERVICE                 GRAIN FUMIGATION              (MMLBS/YR)
        MANUFACTURING N.E.C.                 FIRE EXTINGUISHERS                                  700
        MANUFACTURING AND SERVICE, MISC.                                                        3900
                                                                            40,000     5,000
    PROCESS DESCRIPTION
    -------------------

        51  COPRODUCT OF PERCHLOROETHYLENE PRODUCTION BY THERMAL CHLORINATION
            IPPEU 6/235

        REACTION COMPONENTS                    OCPDB #   ICPDB #        INDUSTRIAL ORIGIN                SIC
        -------------------                    -------   -------        -----------------                ---
              CHLORINE                                     740       CHLORINE                           2812
              HYDROCARBONS                                           PETROLEUM PRODUCT, REFINED         2911

         A MIXTURE OF HYDROCARBONS SUCH AS METHANE, ETHANE, LPG, PROPANE, ETHYLENE
         DICHLORIDE, OR PROCESS WASTES FROM VINYL CHLORIDE MANUFACTURE ARE
         CHLORINATED AT 100-125 C AND .507-1.01 MPA (5-10 ATM) TO YIELD SATURATED
         CHLOROHYDROCARBONS. THESE ARE THEN PYROLYZED TO YIELD MIXTURES OF PRE-
         DOMINATELY TRICHLOROETHYLENE, CARBON TETRACHLORDE, AND PERCHLOROETHYLENE.
         CARBON TETRACHLORIDE AND OTHER DESIRED PRODUCTS ARE SEPARATED AND THE
         REST RETURNED TO THE REACTOR.

       PRODUCING PLANTS
       ----------------

            3350  DOW CHEMICAL U.S.A.                                         80,000 MMLBS./YR.
                  PITTSBURG                           CA  94565
                  CONTRA COSTA                               30
                  SUISUN BAY                           18050001
```

Exhibit C.1-7. (continued)

```
                                                                              PAGE   44
                                                                        LATEST UPDATE: 820908
                                   ORGANIC CHEMICAL PRODUCERS DATA BASE

                                          PRODUCT DATA REPORT


      3370  DOW CHEMICAL U.S.A.
              PLAQUEMINE                                                        125,000 MMLBS./YR.
              IBERVILLE                               LA  70764
              LOWER GRAND                                   106
                                                       8070300
      3700  E. I. DU PONT DE NEMOURS & CO., INC.
              CORPUS CHRISTI                                                    500,000 MMLBS./YR.
              NUECES                                  TX  78400
              SOUTH CORPUS CHRISTI BAY                      214
                                                      12110202
     10170  STAUFFER CHEMICAL CO.
              LOUISVILLE                                                         70,000 MMLBS./YR.
              JEFFERSON                               KY  40216
              SILVER - LITTLE KENTUCKY                       78
                                                       5140101
     11490  VULCAN MATERIALS CO.
              WICHITA                                                            60,000 MMLBS./YR.
              SEDGWICK                                KS  67201
              LOWER MIDDLE ARKANSAS                          99
                                                      11030013
     11500  VULCAN MATERIALS CO.
              GEISMAR                                                            90,000 MMLBS./YR.
              ASCENSION                               LA  70734
              LAKE MAUREPAS                                 106
                                                       8070204
PROCESS DESCRIPTION
-------------------

     52  CHLORINATION OF METHANE
         IPPEU 6/180

     REACTION COMPONENTS                 OCPDB #   ICPDB #      INDUSTRIAL ORIGIN
     -------------------                 -------   -------      -----------------           SIC
          METHANE                                             INDUSTRIAL GAS                ---
          CHLORINE                                     740    CHLORINE                     2813
                                                                                           2812
     OTHER PROCESS MATERIAL
     ----------------------
          LIGHT AS A CATALYST (OPTIONAL)

     METHANE REACTS WITH CHLORINE AT 250-650 C TO PRODUCE CARBON TETRACHLORIDE
     AND VARYING AMOUNTS OF OTHER CHLOROMETHANES. RECYCLING PARTIALLY
     CHLORINATED MATERIALS AND USING LIGHT AS A CATALYST ALLOWS ESSENTIALLY
     COMPLETE CONVERSION TO CARBON TETRACHORIDE. CRUDE CARBON TETRACHLORIDE
     IS GENERALLY PURIFIED BY NEUTRALIZATION AND DRYING, FOLLOWED BY DISTILLA
```

Exhibit C.1-7 (continued)

```
                                                                                   PAGE   45
                                                                          LATEST UPDATE: 820908
                                   ORGANIC CHEMICAL PRODUCERS DATA BASE

                                           PRODUCT DATA REPORT

     TION, ADDITIONAL PURIFICATION CAN BE EFFECTED BY MAINTAINING THE CARBON
     TETRACHLORIDE FOR A PROLONGED PERIOD UNDER TOTAL REFLUX BEFORE ACTUALLY
     STARTING THE DISTILLATION ITSELF.

    PRODUCING PLANTS
    ----------------

          470  ALLIED CHEMICAL CORP.
               MOUNDSVILLE                                                               8,000 MMLBS./YR.
               MARSHALL                                    WV  26041
               MIDDLE UPPER OHIO                                 181
                                                             5030106

         3400  DOW CHEMICAL U.S.A.
               FREEPORT                                                                 135,000 MMLBS./YR.
               BRAZORIA                                    TX  77541
               AUSTIN - OYSTER                                   216
                                                            12040205
   PROCESS DESCRIPTION
   -------------------

       53  CHLORINATION OF CARBON DISULFIDE

    REACTION-COMPONENTS                        UCBOB-%   ICBOB-%      INDUSTRIAL-ORIGIN                     SIC
         CHLORINE                                          740     CHLORINE                                 2812
         CARBON DISULFIDE                        790               INDUSTRIAL ORGANIC CHEMICAL N.E.C.       2869
    OTHER PROCESS MATERIAL
    ----------------------
         IRON

    PRODUCING PLANTS
    ----------------

         4500  FMC CORP.
               SOUTH CHARLESTON                                                        300,000 MMLBS./YR.
               KANAWHA                                     WV  25303
               LOWER KANAWHA                                     234
                                                             5050008

         5880  INLAND CHEMICAL CORP.
               MANATI
                                                           PR
                                                                 244
               CIBUCO-GUAJATACA                             21010002
```

Exhibit C.1-7. (continued)

```
                                                                  PAGE   46
                                                         LATEST UPDATE: 820908
                         ORGANIC CHEMICAL PRODUCERS DATA BASE

                                PRODUCT DATA REPORT


      10140  STAUFFER CHEMICAL CO.                                              200,000 MMLBS./YR.
             LE MOYNE                              AL  36505
             MOBILE                                        5
             MOBILE-TENSAW                           3160204
   PROCESS DESCRIPTION
   -------------------

      54  CHLORINATION OF PARAFFINIC HYDROCARBONS
          IPPEU 6/234

      REACTION COMPONENTS                  OCPDB #   ICPDB #      INDUSTRIAL ORIGIN                   SIC
      -------------------                  -------   -------      -----------------                   ---
            CHLORINE                                   740     CHLORINE                               2812
            PARAFFINIC HYDROCARBONS                            PETROLEUM PRODUCT, REFINED             2911
      OTHER PROCESS MATERIAL
      ----------------------
            SODIUM HYDROXIDE AS A NEUTRALIZER

       IN THE SIMULTANEOUS CHLORINATION AND PYROLYSIS OF PARAFFINIC HYDROCARBONS,
       AN EXCESS OF CHLORINE REACTS WITH ETHANE, PROPANE, LPG, OR NATURAL
       GAS AT 500-700 C. GASEOUS REACTION PRODUCTS ARE QUENCHED AND MOST ORGANICS
       CONDENSED. ANY HYDROCHLORIC ACID REMAINING IN THE CONDENSED CRUDE IS
       NEUTRALIZED WITH DILUTE SODIUM HYDROXIDE, AND THE PRODUCT IS DECANTED
       FROM THE AQUEOUS PHASE, DRIED, AND DISTILLED. LIGHT END ORGANICS SUCH
       AS CARBON TETRACHLORIDE ARE CONDENSED AND PURIFIED BY FURTHER DISTILLATION.
   PROCESS DESCRIPTION
   -------------------

      55  OXYCHLORINATION OF ETHYLENE DICHLORIDE
          IPPEU 6/140

      REACTION COMPONENTS                  OCPDB #   ICPDB #      INDUSTRIAL ORIGIN                   SIC
      -------------------                  -------   -------      -----------------                   ---
            ETHYLENE DICHLORIDE              1244              INDUSTRIAL ORGANIC CHEMICAL N.E.C.     2869
            HYDROCHLORIC ACID                         1380     INORGANIC ACID                         2819
            OXYGEN                                    2130     INDUSTRIAL GAS                         2813
      OTHER PROCESS MATERIAL
      ----------------------
            COPPER CHLORIDE AS AN OXIDATION CATALYST
            OXYCHLORINATION CATALYST
```

Exhibit C.1-7. (continued)

Appendix C
Part 2 - Plastics Industry

Water Discharged, Treated and Untreated, by Point of Discharge, for Industry Groups and Industries: 1978

All figures in billions of gallons, except where noted.

SIC code	Industry group and industry	Water intake	Water discharged	Number of establishments-- Discharging to public sewers	Number of establishments-- Discharging exclusively to public sewers	Water treated by point of discharge: Total	Public utility sewer	Streams and rivers	Lakes and ponds	Bays and estuaries	Ocean	Ground (wells, spray, seepage)	Transferred to other users
282	PLASTICS MATERIALS, SYNTHETICS	481.6	456.9	98	50	110.1	7.8	97.0	(D)	3.4	-	.9	(D)
2821	PLASTICS MATERIALS AND RESINS	150.7	139.1	78	40	27.2	5.4	20.0	(D)	1.1	-	.2	(D)
2822	SYNTHETIC RUBBER	33.2	29.0	6	4	(D)	(D)	7.3	-	(D)	-	(D)	(D)
2823	CELLULOSIC MANMADE FIBERS	109.0	103.9	1	-	(D)	-	35.8	-	-	-	(D)	-
2824	ORGANIC FIBERS, NONCELLULOSIC	188.7	182.9	13	6	36.3	(D)	33.8	(D)	(D)	-	(D)	(D)
30	RUBBER, MISC. PLASTICS PROD.	187.0	167.5	347	150	51.5	3.9	44.0	.7	(D)	-	2.5	(D)
3011	TIRES AND INNER TUBES	41.5	38.7	46	11	23.1	1.2	21.0	(D)	-	-	(D)	-
3041	RUBBER, PLASTICS HOSE AND BELTING	10.2	9.0	22	6	(D)	(Z)	4.3	(D)	-	-	-	-
3069	FABRICATED RUBBER PRODUCTS, NEC	18.9	17.7	93	42	1.5	.8	.6	(D)	(D)	-	(D)	-
3079	MISCELLANEOUS PLASTICS PRODUCTS	114.1	99.9	180	89	22.4	1.9	18.0	(Z)	(D)	-	2.4	(D)

Water Discharged, Treated and Untreated, by Point of Discharge, for Industry Groups and Industries: 1978

All figures in billions of gallons.

SIC code	Industry group and industry	Water untreated by point of discharge: Total	Public utility sewer	Streams and rivers	Lakes and ponds	Bays and estuaries	Ocean	Ground (wells, spray, seepage)	Transferred to other users
282	PLASTICS MATERIALS, SYNTHETICS	344.8	4.7	324.1	(D)	(D)	-	1.8	9.5
2821	PLASTICS MATERIALS AND RESINS	111.9	3.8	100.5	(D)	(D)	-	.4	.8
2822	SYNTHETIC RUBBER	(D)	(D)	(D)	-	-	-	(D)	(D)
2823	CELLULOSIC MANMADE FIBERS	(D)	(D)	(D)	-	-	-	-	-
2824	ORGANIC FIBERS, NONCELLULOSIC	146.6	.8	143.2	(D)	(D)	-	(D)	(D)
30	RUBBER, MISC. PLASTICS PROD.	116.0	50.9	51.3	5.5	(D)	-	6.0	-- (D)
3011	TIRES AND INNER TUBES	15.5	4.4	9.6	(D)	(D)	-	(D)	(D)
3041	RUBBER, PLASTICS HOSE AND BELTING	(D)	(D)	(D)	(D)	-	-	-	-
3069	FABRICATED RUBBER PRODUCTS, NEC	16.3	9.1	4.7	1.9	(D)	-	.1	(D)
3079	MISCELLANEOUS PLASTICS PRODUCTS	77.5	36.2	33.0	(D)	(D)	-	5.8	1.3

Note: Figures shown for industry groups (3-digit) and major industry groups (2-digit) include data for all component industries, whether or not separate figures are shown for individual industries in the group.

Industries which have been omitted from the table have total water discharge of less than .05 or have data being withheld to avoid disclosure.

- Represents zero. (D) Withheld to avoid disclosing operations of individual companies. N.E.C. Not elsewhere classified.

(Z) Less than 50 million gallons.

Exhibit C.2-1. Plastics Industry - Water Discharges

Source: Bureau of Census 1980 (Water Use in Manufacturing)

Water Discharged, Treated and Untreated, by Last Use, for Industry Groups and Industries: 1978

All figures in billions of gallons.

1977 code	Industry group and industry	Water intake	Water discharged								
			Total	Treated water by last use							
				Total	Process	Cooling and condensing			Sanitary service	Boiler feed	Other
						Steam electric power generation	Air conditioning	Other			
282	PLASTICS MATERIALS, SYNTHETICS	481.6	454.9	110.1	72.4	(D)	(D)	23.8	2.4	5.0	4.9
2821	PLASTICS MATERIALS AND RESINS	150.7	139.1	27.2	15.2	-	.2	5.5	.9	3.4	2.1
2822	SYNTHETIC RUBBER	33.2	29.0	(D)	6.8	(D)	.2	(D)	.2	.6	1.4
2823	CELLULOSIC MANMADE FIBERS	109.0	103.9	(D)	34.6	-	(D)	(D)	.2	(D)	(D)
2824	ORGANIC FIBERS, NONCELLULOSIC	180.7	182.9	36.3	15.9	(D)	(D)	16.2	1.1	.9	(D)
30	RUBBER, MISC. PLASTICS PROD.	187.0	167.5	51.5	10.2	1.0	1.9	33.2	1.9	2.8	.5
3011	TIRES AND INNER TUBES	91.5	38.7	23.1	2.6	(D)	.5	17.2	(D)	1.4	.3
3041	RUBBER, PLASTICS HOSE AND BELTING	10.2	9.0	(D)	.2	(D)	(D)	2.8	(D)	(Z)	(D)
3069	FABRICATED RUBBER PRODUCTS, NEC	18.9	17.7	1.5	.6	(D)	(D)	.7	.1	.1	(D)
3079	MISCELLANEOUS PLASTICS PRODUCTS	114.1	99.9	22.4	6.7	-	(D)	12.5	1.5	1.3	(D)

Water Discharged, Treated and Untreated, by Last Use, for Industry Groups and Industries: 1978

All figures in billions of gallons.

1977 code	Industry group and industry	Water discharged--Con.							
		Untreated water by last use							
		Total	Process	Cooling and condensing			Sanitary service	Boiler feed	Other
				Steam electric power generation	Air conditioning	Other			
282	PLASTICS MATERIALS, SYNTHETICS	344.8	12.7	42.7	40.8	229.1	.9	9.5	13.1
2821	PLASTICS MATERIALS AND RESINS	111.9	2.6	(D)	(D)	93.1	.5	(D)	1.6
2822	SYNTHETIC RUBBER	(D)	(D)	-	-	(D)	(D)	-	(D)
2823	CELLULOSIC MANMADE FIBERS	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
2824	ORGANIC FIBERS, NONCELLULOSIC	146.6	4.2	26.6	32.8	70.5	.3	2.8	9.5
30	RUBBER, MISC. PLASTICS PROD.	116.0	14.2	3.8	4.6	67.0	13.0	11.5	1.9
3011	TIRES AND INNER TUBES	15.5	1.5	(D)	(D)	11.0	1.4	1.0	(D)
3041	RUBBER, PLASTICS HOSE AND BELTING	(D)	(D)	-	(D)	(D)	.4	(D)	(D)
3069	FABRICATED RUBBER PRODUCTS, NEC	16.3	2.1	(D)	.7	6.4	(D)	1.0	.7
3079	MISCELLANEOUS PLASTICS PRODUCTS	77.5	8.6	(D)	2.4	43.0	10.5	9.1	(D)

Note: Figures shown for industry groups (3-digit) and major industry groups (2-digit) include data for all component industries, whether or not separate figures are shown for individual industries in the group.

Industries which have been omitted from the table have total water discharge of less than .05 or have data being withheld to avoid disclosure.

- Represents zero. (D) Withheld to avoid disclosing operations of individual companies. N.E.C. Not elsewhere classified.

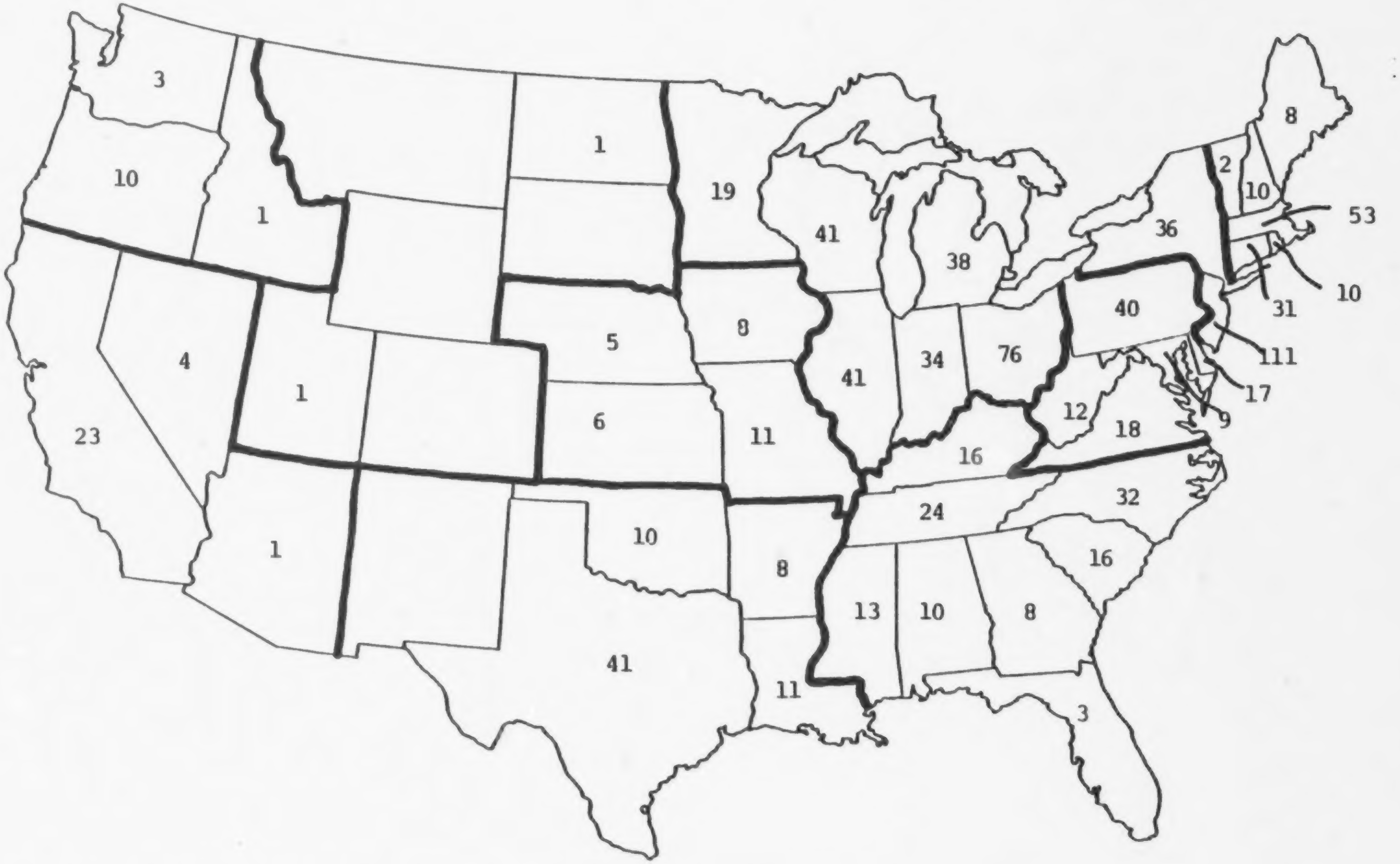
(Z) Less than 50 million gallons.

Exhibit C.2-1 (continued)

Exhibit C.2-2. GEOGRAPHICAL DISTRIBUTION OF INDUSTRIAL FACILITIES

(Based on EPA Regions)

SIC Codes: 2821
3021
3041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76
16
24
13
10
8
16
32
12
18
40
36
2
10
8
53
10
31
111
17
9
3

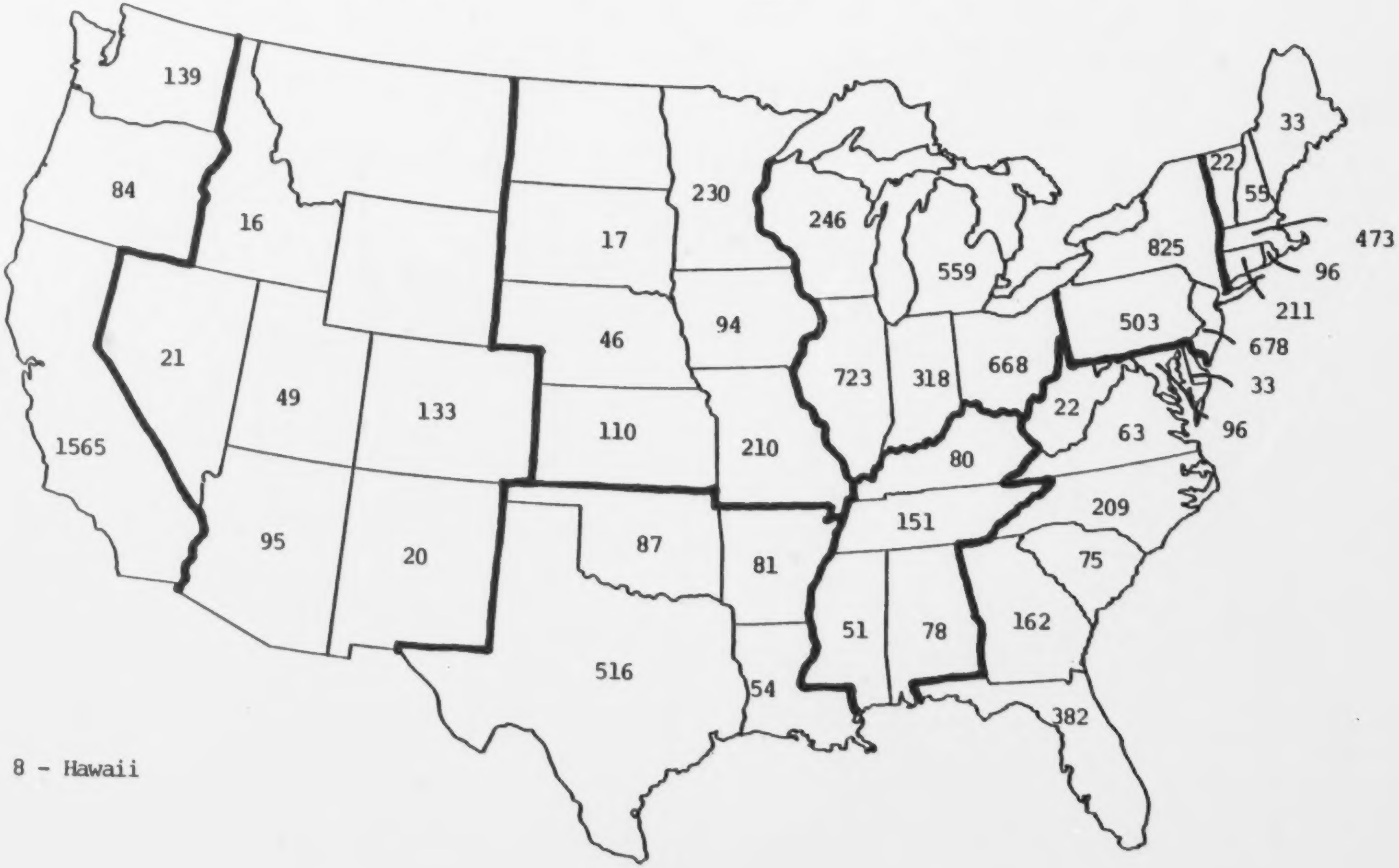
Source: Industrial Facilities Discharge Data Base (IFD)
EPA-OWRS/MDSD/WQAB.

5 - Puerto Rico

Exhibit C.2-3. GEOGRAPHICAL DISTRIBUTION OF INDUSTRIAL FACILITIES

(Based on BoC Regions)

SIC Codes: 3021
3041
3079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46
94
110
723
318
668
22
63
210
80
209
151
95
20
87
81
75
51
78
162
516
54
382
8 - Hawaii

Source: Bureau of Census, 1980a. (1977 Census of Manufacturers, Industry Series MC77-I-30A, Rubber and Miscellaneous Plastic Products.)

Exhibit C.2-4. Environmental Data Summary and Analysis for the Plastics Industry (combined with the Organic Chemicals Manufacturing Industry)

Total number of plants: 2100

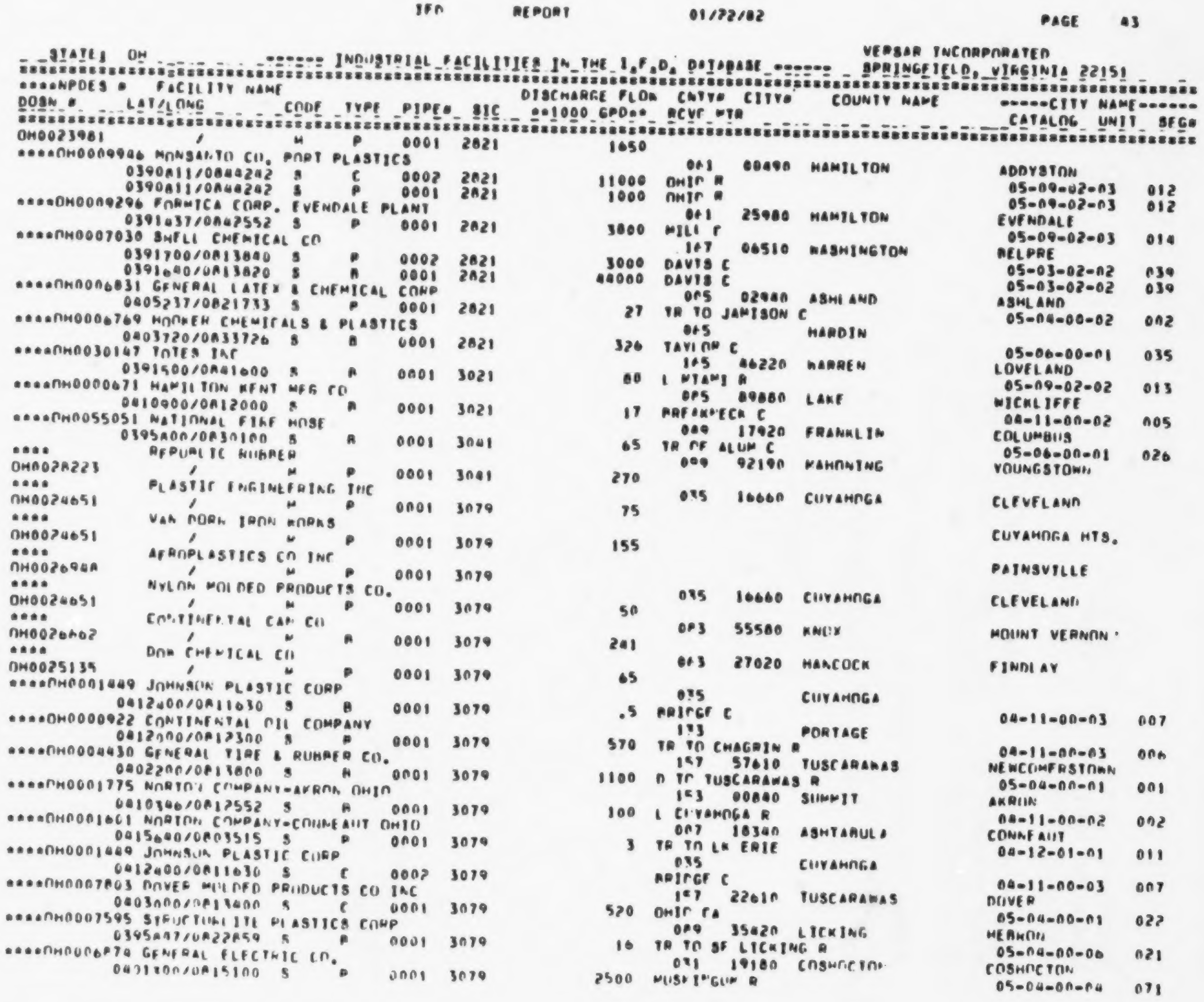
	1° organics	1° plastics	1° both	2° all
Number of direct dischargers:	254	205	42	581
Number of indirect dischargers:	284	116	32	103
Number of other dischargers:	117	236	37	93

Total flow:	2.94	BGD	1073.1	BGY
Total direct flow:	2.31	BGD	843.2	BGY
Total indirect flow:	0.63	BGD	229.9	BGY

Number of operating days per year: 365

SIC codes: 2821, 2823, 2824, 2865, 2869

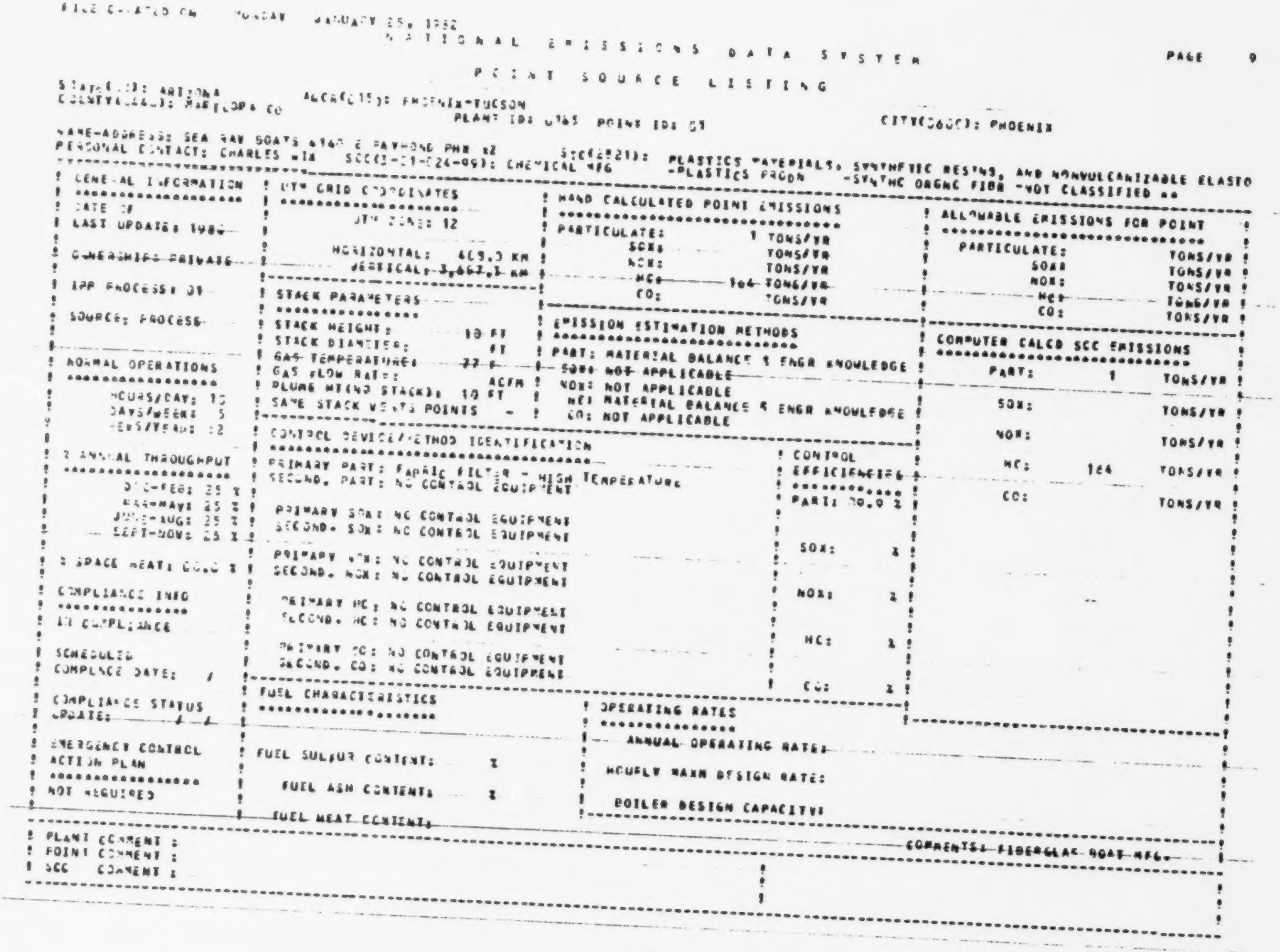
Source: Versar, Inc. 1982. Prepared for EPA-OWRS/MDSD/WQAB.
Data supplied by EPA-OWRS/EGD.



```
                     IFD        REPORT            01/22/82                                   PAGE    43

 _ _STATE: OH _ _ _ _ _ _ ====== INDUSTRIAL FACILITIES IN THE I.F.D. DATABASE ====== _ SPRINGFIELD, VIRGINIA 22151
==========================================================================================================================
****NPDES #   FACILITY NAME                                                                 VERSAR INCORPORATED
DOSN #     LAT/LONG        CODE  TYPE  PIPE#  SIC    DISCHARGE FLOW  CNTY#  CITY#    COUNTY NAME     -----CITY NAME------
=========================================================**1000 GPD**  RCVE WTR _ _ _ _ _ _ _ _ _ _ _CATALOG  UNIT  SEG#
OH0023981            /       M      P    0001  2821          1650
****OH0009946 MONSANTO CO, PORT PLASTICS
                                                                        061    00490  HAMILTON        ADDYSTON
          0390811/0844242   S       C    0002  2821         11000   OHIO R                             05-09-02-03   012
          0390811/0844242   S       P    0001  2821          1000   OHIO R                             05-09-02-03   012
****OH0009296 FORMICA CORP. EVENDALE PLANT
                                                                        061    25980  HAMILTON        EVENDALE
          0391437/0842552   S       P    0001  2821          3800   MILL C                             05-09-02-03   014
****OH0007030 SHELL CHEMICAL CO
                                                                        167    06510  WASHINGTON      BELPRE
          0391700/0813840   S       P    0002  2821          3000   DAVIS C                            05-03-02-02   039
          0391640/0813820   S       B    0001  2821         44000   DAVIS C                            05-03-02-02   039
****OH0006831 GENERAL LATEX & CHEMICAL CORP
                                                                        005    02940  ASHLAND         ASHLAND
          0405237/0821733   S       P    0001  2821            27   TR TO JAMISON C                    05-04-00-02   002
****OH0006769 HOOKER CHEMICALS & PLASTICS
                                                                        065           HARDIN
          0403720/0833726   S       B    0001  2821           326   TAYLOR C                           05-06-00-01   035
****OH0030147 TOTES INC
                                                                        165    46220  WARREN          LOVELAND
          0391500/0841600   S       B    0001  3021            80   L MIAMI R                          05-09-02-02   013
****OH0000671 HAMILTON KENT MFG CO
                                                                        085    89880  LAKE            WICKLIFFE
          0410900/0812000   S       B    0001  3021            17   BREAKNECK C                        04-11-00-02   005
****OH0055051 NATIONAL FIRE HOSE
                                                                        049    17920  FRANKLIN        COLUMBUS
          0395800/0830100   S       B    0001  3041            65   TR OF ALUM C                       05-06-00-01   026
****           REPUBLIC RUBBER
                                                                        099    92190  MAHONING        YOUNGSTOWN
OH0028223            /       M      P    0001  3041           270
****           PLASTIC ENGINEERING INC
                                                                        035    16660  CUYAHOGA        CLEVELAND
OH0024651            /       M      P    0001  3079            75
****           VAN DORN IRON WORKS
OH0024651            /       M      P    0001  3079           155                                     CUYAHOGA HTS.
****           AEROPLASTICS CO INC
OH0026948            /       M      P    0001  3079                                                   PAINSVILLE
****           NYLON MOLDED PRODUCTS CO.
                                                                        035    16660  CUYAHOGA        CLEVELAND
OH0024651            /       M      P    0001  3079            50
****           CONTINENTAL CAN CO
                                                                        083    55580  KNOX            MOUNT VERNON
OH0026602            /       M      B    0001  3079           241
****           DOW CHEMICAL CO
                                                                        063    27020  HANCOCK         FINDLAY
OH0025135            /       M      P    0001  3079            65
****OH0001449 JOHNSON PLASTIC CORP
                                                                        035           CUYAHOGA
          0412400/0811630   S       B    0001  3079            .5   BRIDGE C                           04-11-00-03   007
****OH0000922 CONTINENTAL OIL COMPANY
                                                                        133           PORTAGE
          0412000/0812300   S       P    0001  3079           570   TR TO CHAGRIN R                    04-11-00-03   006
****OH0004430 GENERAL TIRE & RUBBER CO.
                                                                        157    57610  TUSCARAWAS      NEWCOMERSTOWN
          0402200/0813800   S       B    0001  3079          1100   D TO TUSCARAWAS R                  05-04-00-01   001
****OH0001775 NORTON COMPANY-AKRON OHIO
                                                                        153    00840  SUMMIT          AKRON
          0410346/0812552   S       B    0001  3079           100   L CUYAHOGA R                       04-11-00-02   002
****OH0001601 NORTON COMPANY-CONNEAUT OHIO
                                                                        007    18340  ASHTABULA       CONNEAUT
          0415640/0803515   S       P    0001  3079             3   TR TO LK ERIE                      04-12-01-01   011
****OH0001449 JOHNSON PLASTIC CORP
                                                                        035           CUYAHOGA
          0412400/0811630   S       C    0002  3079                 BRIDGE C                           04-11-00-03   007
****OH0007803 DOVER MOLDED PRODUCTS CO INC
                                                                        157    22610  TUSCARAWAS      DOVER
          0403000/0813400   S       C    0001  3079           520   OHIO CA                            05-04-00-01   022
****OH0007595 STRUCTURLITE PLASTICS CORP
                                                                        089    35420  LICKING         HEBRON
          0395837/0822859   S       P    0001  3079            16   TR TO SF LICKING R                 05-04-00-06   021
****OH0006874 GENERAL ELECTRIC CO.
                                                                        031    19180  COSHOCTON       COSHOCTON
          0401100/0815100   S       P    0001  3079          2500   MUSKINGUM R                        05-04-00-04   071
```

Exhibit C.2-5. Example of IFD Retrieval.



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FILE CREATED ON   MONDAY   JANUARY 25, 1982
                          N A T I O N A L   E M I S S I O N S   D A T A   S Y S T E M                          PAGE    9
                                          P O I N T   S O U R C E   L I S T I N G
STATE(03): ARIZONA            AQCR(015): PHOENIX-TUCSON
COUNTY(0440): MARICOPA CO                          PLANT ID: 0765  POINT ID: 01                 CITY(6600): PHOENIX
NAME-ADDRESS: SEA RAY BOATS 6760 E RAYMOND PHX AZ
PERSONAL CONTACT: CHARLES W16   SCC(3-01-024-99): CHEMICAL MFG     SIC(2821):  PLASTICS MATERIALS, SYNTHETIC RESINS, AND NONVULCANIZABLE ELASTO
                                                                                -PLASTICS PRODN   -SYNTHC ORGNC FIBR -NOT CLASSIFIED **
---------------------------------------------------------------------------------------------------------------------------
! GENERAL INFORMATION  ! UTM GRID COORDINATES          ! HAND CALCULATED POINT EMISSIONS        ! ALLOWABLE EMISSIONS FOR POINT    !
! ******************** ! ***********************       ! ******************************         ! ******************************   !
! DATE OF              !         UTM ZONE: 12          ! PARTICULATE:            1 TONS/YR      !   PARTICULATE:           TONS/YR !
! LAST UPDATE: 1980    !                               !         SOX:              TONS/YR      !           SOX:           TONS/YR !
!                      !     HORIZONTAL:   469.0 KM    !         NOX:              TONS/YR      !           NOX:           TONS/YR !
! OWNERSHIP: PRIVATE   !      VERTICAL: 3,667.1 KM     !          HC:          104 TONS/YR      !            HC:           TONS/YR !
!                      !-------------------------------!          CO:              TONS/YR      !            CO:           TONS/YR !
! IPP PROCESS: 01      ! STACK PARAMETERS              !----------------------------------------!----------------------------------!
!                      ! ****************              ! EMISSION ESTIMATION METHODS            ! COMPUTER CALCD SCC EMISSIONS     !
! SOURCE: PROCESS      ! STACK HEIGHT:          10 FT  ! ***************************            ! ******************************   !
!                      ! STACK DIAMETER:           FT  ! PART: MATERIAL BALANCE & ENGR KNOWLEDGE !       PART:        1    TONS/YR !
!----------------------! GAS TEMPERATURE:       77 F   !  SOX: NOT APPLICABLE                   !                                  !
! NORMAL OPERATIONS    ! GAS FLOW RATE:          ACFM  !  NOX: NOT APPLICABLE                   !        SOX:             TONS/YR !
! ******************   ! PLUME HT(NO STACK):    10 FT  !   HC: MATERIAL BALANCE & ENGR KNOWLEDGE !                                  !
!      HOURS/DAY: 10   ! SAME STACK VENTS POINTS   -   !   CO: NOT APPLICABLE                   !        NOX:             TONS/YR !
!      DAYS/WEEK:  5   !--------------------------------------------------------------------------!                                  !
!     WEEKS/YEAR: 52   ! CONTROL DEVICE/METHOD IDENTIFICATION                 ! CONTROL          !         HC:       164   TONS/YR !
!                      ! ************************************                 ! EFFICIENCIES     !                                  !
! % ANNUAL THROUGHPUT  ! PRIMARY PART: FABRIC FILTER - HIGH TEMPERATURE      ! ************     !         CO:             TONS/YR !
! ******************** ! SECOND. PART: NO CONTROL EQUIPMENT                   ! PART: 90.0 %     !                                  !
!        DEC-FEB: 25 % !                                                      !                  !                                  !
!        MAR-MAY: 25 % !  PRIMARY SOX: NO CONTROL EQUIPMENT                   !                  !                                  !
!       JUNE-AUG: 25 % !  SECOND. SOX: NO CONTROL EQUIPMENT                   !   SOX:        %  !                                  !
!       SEPT-NOV: 25 % !                                                      !                  !                                  !
!                      !  PRIMARY NOX: NO CONTROL EQUIPMENT                   !                  !                                  !
! % SPACE HEAT: 00.0 % !  SECOND. NOX: NO CONTROL EQUIPMENT                   !   NOX:        %  !                                  !
!                      !                                                      !                  !                                  !
! COMPLIANCE INFO      !   PRIMARY HC: NO CONTROL EQUIPMENT                   !                  !                                  !
! ***************      !   SECOND. HC: NO CONTROL EQUIPMENT                   !    HC:        %  !                                  !
! IN COMPLIANCE        !                                                      !                  !                                  !
!                      !   PRIMARY CO: NO CONTROL EQUIPMENT                   !                  !                                  !
! SCHEDULED            !   SECOND. CO: NO CONTROL EQUIPMENT                   !    CO:        %  !                                  !
! COMPLNCE DATE:   /   !---------------------------------------------------------------------------!----------------------------------
!                      ! FUEL CHARACTERISTICS               ! OPERATING RATES                                                     !
! COMPLIANCE STATUS    ! ********************               ! ***************                                                     !
! UPDATE:        / /   !------------------------------------!   ANNUAL OPERATING RATE:                                            !
!                      !                                    !                                                                     !
! EMERGENCY CONTROL    ! FUEL SULFUR CONTENT:       %       !  HOURLY MAXM DESIGN RATE:                                           !
! ACTION PLAN          !                                    !                                                                     !
! ****************     !   FUEL ASH CONTENT:        %       !   BOILER DESIGN CAPACITY:                                           !
! NOT REQUIRED         !                                    !---------------------------------------------------------------------
!                      !   FUEL HEAT CONTENT:                                                                                     !
---------------------------------------------------------------------------------------------------------------------------
! PLANT COMMENT :                                                                             COMMENTS: FIBERGLAS BOAT MFG.      !
! POINT COMMENT :                                                                                                                !
! SCC   COMMENT :                                                           !                                                    !
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Exhibit C.2-6. Example of NEDS Retrieval

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FILE CREATED ON    MONDAY   JANUARY 25, 1982
                         N A T I O N A L   E M I S S I O N S   D A T A   S Y S T E M                PAGE  382

                                    P O I N T   S O U R C E   L I S T I N G

STATE(30): NEW HAMPSHIRE   AQCR(121): MERRIMACK VALLEY-SOUTHERN NEW HAMPSHIRE
COUNTY(1300): HILLSBOROUGH CO                    PLANT ID: 0078  POINT ID: 03          CITY(0420): MANCHESTER

NAME-ADDRESS: PREVUE PRODUCTS,175 MCGREGOR,MANCHESTER  SIC(3021): RUBBER AND PLASTICS FOOTWEAR
PERSONAL CONTACT: DIR OF RES    SCC(4-02-999-95): ORGANIC SOLVENT  -SURFACE COATING  -MISCELLANEOUS    -SEE COMMENT   **
-----------------------------------------------------------------------------------------------------------------------
! GENERAL INFORMATION  ! UTM GRID COORDINATES     ! HAND CALCULATED POINT EMISSIONS     ! ALLOWABLE EMISSIONS FOR POINT  !
! ******************** ! ********************     ! *********************************** ! ****************************** !
! DATE OF              !       UTM ZONE: 19       ! PARTICULATE:            TONS/YR     !   PARTICULATE:         TONS/YR !
! LAST UPDATE: 1979    !                          !         SOX:            TONS/YR     !           SOX:         TONS/YR !
!                      !  HORIZONTAL:   299.4 KM  !         NOX:            TONS/YR     !           NOX:         TONS/YR !
! OWNERSHIP: PRIVATE   !    VERTICAL: 4,762.0 KM  !          HC:       392 TONS/YR     !            HC:       9 TONS/YR !
!                      !--------------------------!          CO:            TONS/YR     !            CO:         TONS/YR !
! IPP PROCESS: 0       ! STACK PARAMETERS         !-------------------------------------!--------------------------------!
!                      ! ****************         ! EMISSION ESTIMATION METHODS         ! COMPUTER CALCD SCC EMISSIONS   !
! SOURCE: PROCESS      ! STACK HEIGHT:      3? FT ! *************************           ! ****************************** !
!                      ! STACK DIAMETER:   2.? FT ! PART: CONFIDENTIAL DATA, NOT RELEASED !    PART:             TONS/YR !
! NORMAL OPERATIONS    ! GAS TEMPERATURE:    75 F !  SOX: CONFIDENTIAL DATA, NOT RELEASED !                              !
! *****************    ! GAS FLOW RATE: 6,70? ACFM !  NOX: CONFIDENTIAL DATA, NOT RELEASED !    SOX:              TONS/YR !
!     HOURS/DAY: 12    ! PLUME HT(NO STACK):   FT !   HC: CONFIDENTIAL DATA, NOT RELEASED !                              !
!     DAYS/WEEK:  5    ! SAME STACK VENTS POINTS - !   CO: CONFIDENTIAL DATA, NOT RELEASED !    NOX:              TONS/YR !
!    WEEKS/YEAR:  4    !--------------------------------------------------------------!                              !
!                      ! CONTROL DEVICE/METHOD IDENTIFICATION        ! CONTROL          !     HC:      ?92     TONS/YR !
! % ANNUAL THROUGHPUT  ! ************************************        ! EFFICIENCIES     !                              !
! ******************** ! PRIMARY PART: NO CONTROL EQUIPMENT          ! ************     !     CO:              TONS/YR !
!      DEC-FEB: 25 %   ! SECOND. PART: NO CONTROL EQUIPMENT          ! PART: 00.0 %     !                              !
!      MAR-MAY: 25 %   !                                             !                  !                              !
!      JUN-AUG: 25 %   !  PRIMARY SOX: NO CONTROL EQUIPMENT          !  SOX: 00.0 %     !                              !
!     SEPT-NOV: 25 %   !  SECOND. SOX: NO CONTROL EQUIPMENT          !                  !                              !
!                      !                                             !  NOX: 00.0 %     !                              !
! % SPACE HEAT: 00.0 % !  PRIMARY NOX: NO CONTROL EQUIPMENT          !                  !                              !
!                      !  SECOND. NOX: NO CONTROL EQUIPMENT          !   HC: 00.0 %     !                              !
! COMPLIANCE INFO      !                                             !                  !                              !
! ***************      !   PRIMARY HC: NO CONTROL EQUIPMENT          !   CO: 00.0 %     !                              !
! IN COMPLIANCE        !   SECOND. HC: NO CONTROL EQUIPMENT          !                  !                              !
!                      !                                             !                  !                              !
! SCHEDULED            !   PRIMARY CO: NO CONTROL EQUIPMENT          !                  !                              !
! COMPLIANCE DATE:   / !   SECOND. CO: NO CONTROL EQUIPMENT          !                  !                              !
!                      !-----------------------------------------------------------------!------------------------------!
! COMPLIANCE STATUS    ! FUEL CHARACTERISTICS        ! OPERATING RATES                                                 !
! UPDATE:        /  /  ! ********************        ! ***************                                                 !
!                      !                             !    ANNUAL OPERATING RATE:  CONFID.  TONS COATING                !
! EMERGENCY CONTROL    ! FUEL SULFUR CONTENT:   %    !                                                                 !
! ACTION PLAN          !                             !  HOURLY MAXM DESIGN RATE:  CONFID.  TONS COATING                !
! ***************      !   FUEL ASH CONTENT:    %    !                                                                 !
! STATUS UNKNOWN       !                             !   BOILER DESIGN CAPACITY:  CONFID.  MILLION BTU/HR              !
!                      !  FUEL HEAT CONTENT:         !-----------------------------------------------------------------!
!                      !                             !                          COMMENTS: SPRAY ROLLERCOAT             !
-----------------------------------------------------------------------------------------------------------------------
! PLANT COMMENT :                                        !                                                            !
! POINT COMMENT :                                        !                                                            !
! SCC   COMMENT :                                        !                                                            !
-----------------------------------------------------------------------------------------------------------------------
```

Exhibit C.2-6. Example of NEDS Retrieval (cont'd)

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FILE CREATED ON    MONDAY   JANUARY 25, 1982                                                                              PAGE  239
                                        N A T I O N A L   E M I S S I O N S   D A T A   S Y S T E M

                                                    P O I N T   S O U R C E   L I S T I N G
-----------------------------------------------------------------------------------------------------------------------------------
STATE(14): ILLINOIS          AQCR(065): BURLINGTON-KEOKUK                                         CITY(2740): GALESBURG
COUNTY(3920): KNOX CO                       PLANT ID: 0016  POINT ID: 10

NAME-ADDRESS: GATES GALESBURG HOSERY * KNOXVILLE ROAD   SIC(3041):  RUBBER AND PLASTICS HOSE AND BELTING
PERSONAL CONTACT: H D HARRIS     SCC(3-01-026-99): CHEMICAL MFG     -PLASTICS PRODN    -SYNTHETIC RUBBER  -NOT CLASSIFIED
-----------------------------------------------------------------------------------------------------------------------------------
! GENERAL INFORMATION  ! UTM GRID COORDINATES              ! HAND CALCULATED POINT EMISSIONS       ! ALLOWABLE EMISSIONS FOR POINT    !
! *******************  ! ********************              ! ******************************        ! *******************************  !
! DATE OF              !          UTM ZONE: 15             ! PARTICULATE:          14 TONS/YR      !   PARTICULATE:           TONS/YR !
! LAST UPDATE: 1979    !                                   !          SOX:          0 TONS/YR      !           SOX:           TONS/YR !
!                      !       HORIZONTAL:   725.4 KM      !          NOX:          0 TONS/YR      !           NOX:           TONS/YR !
! OWNERSHIP: PRIVATE   !         VERTICAL: 4,533.4 KM      !           HC:        109 TONS/YR      !            HC:           TONS/YR !
!                      !-----------------------------------!           CO:          0 TONS/YR      !            CO:           TONS/YR !
! IPP PROCESS:         ! STACK PARAMETERS                  !---------------------------------------!----------------------------------!
!                      ! ****************                  ! EMISSION ESTIMATION METHODS           ! COMPUTER CALCD SCC EMISSIONS     !
! SOURCE: PROCESS      ! STACK HEIGHT:            30 FT    ! ***************************           ! ****************************     !
!                      ! STACK DIAMETER:         1.0 FT    ! PART: CONFIDENTIAL DATA, NOT RELEASED !      PART:        14     TONS/YR !
!                      ! GAS TEMPERATURE:         70 F     !  SOX: CONFIDENTIAL DATA, NOT RELEASED !                                  !
! NORMAL OPERATIONS    ! GAS FLOW RATE:           50 ACFM  !  NOX: CONFIDENTIAL DATA, NOT RELEASED !       SOX:               TONS/YR !
! *****************    ! PLUME HT(NO STACK):         FT    !   HC: CONFIDENTIAL DATA, NOT RELEASED !                                  !
!       HOURS/DAY: 24  ! SAME STACK W/OTHER POINTS   -     !   CO: CONFIDENTIAL DATA, NOT RELEASED !       NOX:               TONS/YR !
!       DAYS/WEEK:  5  !-----------------------------------------------------------------------------!                                  !
!      WEEKS/YEAR: 4   ! CONTROL DEVICE/METHOD IDENTIFICATION                       ! CONTROL          !        HC:       169     TONS/YR !
!                      ! **********************************                         ! EFFICIENCIES     !                                  !
! % ANNUAL THROUGHPUT  ! PRIMARY PART: NO CONTROL EQUIPMENT                         ! ************     !        CO:               TONS/YR !
! *******************  ! SECOND. PART: NO CONTROL EQUIPMENT                         ! PART:      %     !                                  !
!      DEC-FEB: 25 %   !                                                            !                  !                                  !
!      MAR-MAY: 25 %   !  PRIMARY SOX: NO CONTROL EQUIPMENT                         !                  !                                  !
!      JUN-AUG: 25 %   !  SECOND. SOX: NO CONTROL EQUIPMENT                         !  SOX:      %     !                                  !
!     SEPT-NOV: 25 %   !                                                            !                  !                                  !
!                      !  PRIMARY NOX: NO CONTROL EQUIPMENT                         !                  !                                  !
! % SPACE HEAT: 00.0 % !  SECOND. NOX: NO CONTROL EQUIPMENT                         !  NOX:      %     !                                  !
!                      !                                                            !                  !                                  !
! COMPLIANCE INFO      !   PRIMARY HC: NO CONTROL EQUIPMENT                         !                  !                                  !
! ***************      !   SECOND. HC: NO CONTROL EQUIPMENT                         !   HC:      %     !                                  !
! IN COMPLIANCE        !                                                            !                  !----------------------------------!
!                      !   PRIMARY CO: NO CONTROL EQUIPMENT                         !                  !                                  !
! SCHEDULED            !   SECOND. CO: NO CONTROL EQUIPMENT                         !   CO:      %     !                                  !
! COMPLNCE DATE:   /   !----------------------------------------------------------------------------- !                                  !
!                      ! FUEL CHARACTERISTICS               ! OPERATING RATES                                                         !
! COMPLIANCE STATUS    ! ********************               ! ***************                                                         !
! UPDATE:        / /   !                                    !    ANNUAL OPERATING RATE:  CONFID.  TONS PRODUCT                        !
!                      !                                    !                                                                         !
! EMERGENCY CONTROL    ! FUEL SULFUR CONTENT:        %      !  HOURLY MAXM DESIGN RATE:  CONFID.  TONS PRODUCT                        !
! ACTION PLAN          !                                    !                                                                         !
! *****************    !   FUEL ASH CONTENT:         %      !   BOILER DESIGN CAPACITY:  CONFID.  MILLION BTU/HR                      !
! NOT REQUIRED         !                                    !-------------------------------------------------------------------------!
!                      !  FUEL HEAT CONTENT:                                               COMMENTS:                                  !
-----------------------------------------------------------------------------------------------------------------------------------
! PLANT COMMENT :                                                   !                                                               !
! POINT COMMENT :                                                   !                                                               !
! SCC   COMMENT :                                                   !                                                               !
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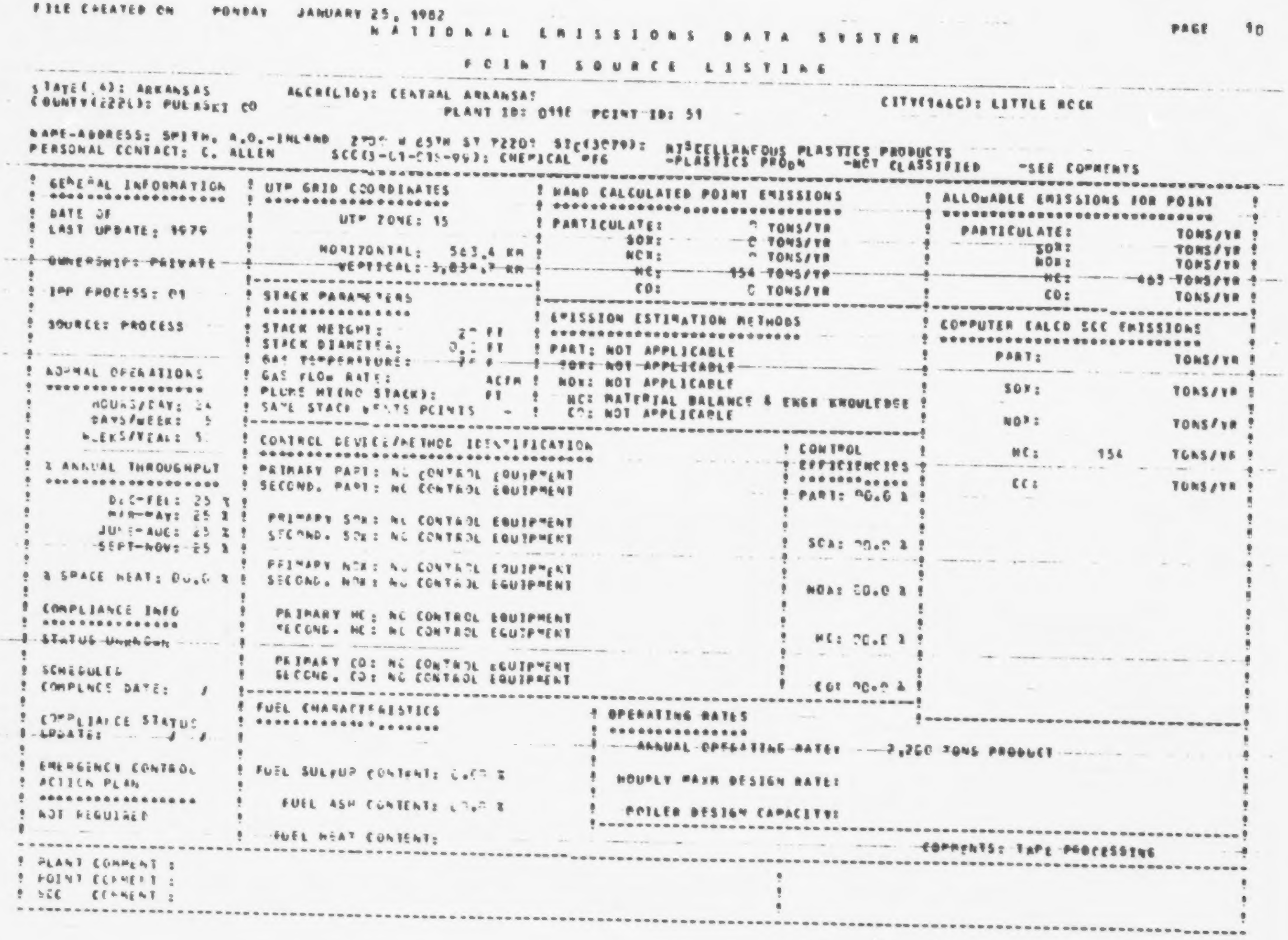
Exhibit C.2-6. Example of NEDS Retrieval (cont'd)



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FILE CREATED ON    MONDAY   JANUARY 25, 1982                                                                     PAGE   10
                                   N A T I O N A L   E M I S S I O N S   D A T A   S Y S T E M

                                                 P O I N T   S O U R C E   L I S T I N G
STATE( 4): ARKANSAS            AQCR(016): CENTRAL ARKANSAS
COUNTY(2220): PULASKI CO                           PLANT ID: 099E  POINT ID: 51              CITY(1440): LITTLE ROCK

NAME-ADDRESS: SMITH, A.O.-INLAND  2[illegible] W 65TH ST 72209  SIC(3079):  MISCELLANEOUS PLASTICS PRODUCTS
PERSONAL CONTACT: C. ALLEN       SCC(3-01-018-99): CHEMICAL MFG     -PLASTICS PRODN    -NOT CLASSIFIED    -SEE COMMENTS
-------------------------------------------------------------------------------------------------------------------------
! GENERAL INFORMATION  ! UTM GRID COORDINATES          ! HAND CALCULATED POINT EMISSIONS       ! ALLOWABLE EMISSIONS FOR POINT   !
! *******************  ! *********************         ! *******************************       ! ******************************  !
! DATE OF              !         UTM ZONE: 15          ! PARTICULATE:          0 TONS/YR       !   PARTICULATE:           TONS/YR !
! LAST UPDATE: 1979    !                               !         SOX:          0 TONS/YR       !           SOX:           TONS/YR !
!                      !     HORIZONTAL:   563.4 KM    !         NOX:          0 TONS/YR       !           NOX:           TONS/YR !
! OWNERSHIP: PRIVATE   !       VERTICAL: 3,83[illegible].7 KM   !          HC:        154 TONS/YR       !            HC:       463 TONS/YR !
!                      !-------------------------------!          CO:          0 TONS/YR       !            CO:           TONS/YR !
! IPP PROCESS: 01      ! STACK PARAMETERS              !---------------------------------------!---------------------------------!
!                      ! ****************              ! EMISSION ESTIMATION METHODS           ! COMPUTER CALCD SCC EMISSIONS    !
! SOURCE: PROCESS      ! STACK HEIGHT:        [illegible] FT    ! ***************************           ! ******************************  !
!                      ! STACK DIAMETER:      0.[illegible] FT    ! PART: NOT APPLICABLE                  !        PART:             TONS/YR !
!----------------------! GAS TEMPERATURE:     [illegible] F     ! SOX: NOT APPLICABLE                   !                                 !
! NORMAL OPERATIONS    ! GAS FLOW RATE:          ACFM  ! NOX: NOT APPLICABLE                   !        SOX:              TONS/YR !
! *****************    ! PLUME HT(NO STACK):       FT  !  HC: MATERIAL BALANCE & ENGR KNOWLEDGE !                                 !
!      HOURS/DAY: 24   ! SAME STACK VENTS POINTS   -   !  CO: NOT APPLICABLE                   !        NOX:              TONS/YR !
!      DAYS/WEEK:  5   !-----------------------------------------------------------------------!                                 !
!     WEEKS/YEAR: 5[illegible]  ! CONTROL DEVICE/METHOD IDENTIFICATION                   ! CONTROL      !         HC:     154      TONS/YR !
!                      ! ************************************                   ! EFFICIENCIES !                                 !
! % ANNUAL THROUGHPUT  ! PRIMARY PART: NO CONTROL EQUIPMENT                     ! ************ !         CO:              TONS/YR !
! *******************  ! SECOND. PART: NO CONTROL EQUIPMENT                     ! PART: 00.0 % !                                 !
!       DEC-FEB: 25 %  !                                                        !              !                                 !
!       MAR-MAY: 25 %  !  PRIMARY SOX: NO CONTROL EQUIPMENT                     !              !                                 !
!       JUN-AUG: 25 %  !  SECOND. SOX: NO CONTROL EQUIPMENT                     !  SOX: 00.0 % !                                 !
!      SEPT-NOV: 25 %  !                                                        !              !                                 !
!                      !  PRIMARY NOX: NO CONTROL EQUIPMENT                     !              !                                 !
! % SPACE HEAT: 00.0 % !  SECOND. NOX: NO CONTROL EQUIPMENT                     !  NOX: 00.0 % !                                 !
!                      !                                                        !              !                                 !
! COMPLIANCE INFO      !   PRIMARY HC: NO CONTROL EQUIPMENT                     !              !                                 !
! ***************      !   SECOND. HC: NO CONTROL EQUIPMENT                     !   HC: 00.0 % !                                 !
! STATUS UNKNOWN       !                                                        !              !                                 !
!                      !   PRIMARY CO: NO CONTROL EQUIPMENT                     !              !                                 !
! SCHEDULED            !   SECOND. CO: NO CONTROL EQUIPMENT                     !   CO: 00.0 % !                                 !
! COMPLNCE DATE:   /   !-----------------------------------------------------------------------!---------------------------------!
!                      ! FUEL CHARACTERISTICS                 ! OPERATING RATES                                                   !
! COMPLIANCE STATUS    ! ********************                 ! ***************                                                   !
! UPDATE:        /  /  !                                      !   ANNUAL OPERATING RATE:    2,260 TONS PRODUCT                    !
!                      !                                      !                                                                   !
! EMERGENCY CONTROL    ! FUEL SULFUR CONTENT: 0.00 %          !  HOURLY MAXM DESIGN RATE:                                         !
! ACTION PLAN          !                                      !                                                                   !
! ****************     !    FUEL ASH CONTENT: 00.0 %          !   BOILER DESIGN CAPACITY:                                         !
! NOT REQUIRED         !                                      !-------------------------------------------------------------------!
!                      !   FUEL HEAT CONTENT:                 !                                  COMMENTS: TAPE PROCESSING        !
-------------------------------------------------------------------------------------------------------------------------
! PLANT COMMENT :                                                                        !                                 !
! POINT COMMENT :                                                                        !                                 !
! SCC   COMMENT :                                                                        !                                 !
-------------------------------------------------------------------------------------------------------------------------
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Exhibit C.2-6. Example of NEDS Retrieval (cont'd)

Appendix C
Part 3 - Lubrication and Hydraulic Fluids Industry

Water Discharged, Treated and Untreated, by Point of Discharge, for Industry Groups and Industries: 1978

All figures in billions of gallons, except where noted.

SIC code	Industry group and industry	Water intake	Water discharged	Number of establishments-- Discharging to public sewers	Number of establishments-- Discharging exclusively to public sewers	Water treated by point of discharge: Total	Public utility sewer	Streams and rivers	Lakes and ponds	Bays and estuaries	Ocean	Ground (wells, spray, seepage)	Transferred to other users
29	PETROLEUM AND COAL PRODUCTS. .	1 172.5	963.7	119	42	580.8	11.9	365.1	45.7	142.0	3.3	2.8	10.6
2911	PETROLEUM REFINING	1 149.9	955.3	82	22	577.2	10.6	362.3	45.7	142.0	3.3	2.7	10.6
295	PAVING AND ROOFING MATERIALS . .	21.6	7.9	28	15	3.4	(D)	(D)	-	-	-	(D)	-
2951	PAVING MIXTURES AND BLOCKS	(D)	2.7	3	2	(D)	-	(Z)	-	-	-	(D)	-
2952	ASPHALT FELTS AND COATINGS	(D)	5.2	25	13	(D)	(D)	(D)	-	-	-	-	-
299	MISC. PETROLEUM, COAL PRODUCTS .	1.6	.6	9	5	.2	(D)	(D)	-	-	(Z)	(D)	-
2992	LUBRICATING OILS AND GREASES . . .	.9	.3	6	3	(D)	(D)	(D)	-	-	-	-	-
2999	PETROLEUM AND COAL PRODUCTS, NEC .	1.2	.2	3	2	(D)	-	(D)	-	-	(Z)	(D)	-

Water Discharged, Treated and Untreated, by Point of Discharge, for Industry Groups and Industries: 1978

All figures in billions of gallons.

SIC code	Industry group and industry	Water untreated by point of discharge: Total	Public utility sewer	Streams and rivers	Lakes and ponds	Bays and estuaries	Ocean	Ground (wells, spray, seepage)	Transferred to other users
29	PETROLEUM AND COAL PRODUCTS.	382.9	40.5	234.6	(D)	93.3	(D)	2.4	10.6
2911	PETROLEUM REFINING	378.1	38.6	234.4	(D)	93.3	(D)	1.3	9.0
295	PAVING AND ROOFING MATERIALS	4.5	1.8	.1	(D)	-	-	.9	(D)
2951	PAVING MIXTURES AND BLOCKS	(D)	(D)	-	(D)	-	-	.9	(D)
2952	ASPHALT FELTS AND COATINGS	(D)	(D)	.1	-	-	-	(Z)	-
299	MISC. PETROLEUM, COAL PRODUCTS	.4	.1	.1	(D)	-	-	(D)	(D)
2992	LUBRICATING OILS AND GREASES	(D)	.1	(D)	-	-	-	-	-
2999	PETROLEUM AND COAL PRODUCTS, NEC	(D)	(Z)	(D)	(D)	-	-	(D)	(D)

Note: Figures shown for industry groups (3-digit) and major industry groups (2-digit) include data for all component industries, whether or not separate figures are shown for individual industries in the group.

Industries which have been omitted from the table have total water discharge of less than .05 or have data being withheld to avoid disclosure.

- Represents zero. (D) Withheld to avoid disclosing operations of individual companies. N.E.C. Not elsewhere classified.

(Z) Less than 50 million gallons.

Exhibit C.3-1. Lubrication and Hydraulic Fluids Industry - Water Dischargers
Source: Bureau of Census 1980 (Water Use in Manufacturing)

Water Discharged, Treated and Untreated, by Last Use, for Industry Groups and Industries: 1978

All figures in billion of gallons.

1977 code	Industry group and industry	Water intake	Water discharged: Total	Treated water by last use: Total	Treated water by last use: Process	Cooling and condensing: Steam electric power generation	Cooling and condensing: Air conditioning	Cooling and condensing: Other	Sanitary service	Boiler feed	Other
29	PETROLEUM AND COAL PRODUCTS	1 172.5	963.7	580.8	58.3	1.2	1.1	418.1	13.3	30.2	58.6
2911	PETROLEUM REFINING	1 149.4	955.3	577.2	57.3	1.2	1.1	416.0	13.0	30.1	58.6
295	PAVING AND ROOFING MATERIALS	21.6	7.9	3.4	.9	-	(D)	2.1	(D)	(Z)	(Z)
2951	PAVING MIXTURES AND BLOCKS	(D)	2.7	(D)	(D)	-	-	-	-	-	(Z)
2952	ASPHALT FELTS AND COATINGS	(D)	5.2	(D)	.8	-	(D)	2.1	(D)	(Z)	-
299	MISC. PETROLEUM, COAL PRODUCTS	1.6	.4	.2	.1	-	-	(D)	(D)	(Z)	(D)
2992	LUBRICATING OILS AND GREASES	.9	.3	(D)	.1	-	-	(D)	-	(Z)	(D)
2999	PETROLEUM AND COAL PRODUCTS, NEC	1.2	.2	(D)	-	-	-	-	(D)	-	(D)

Water Discharged, Treated and Untreated, by Last Use, for Industry Groups and Industries: 1978

All figures in billion of gallons.

1977 code	Industry group and industry	Water discharged--Con. Untreated water by last use: Total	Process	Cooling and condensing: Steam electric power generation	Cooling and condensing: Air conditioning	Cooling and condensing: Other	Sanitary service	Boiler feed	Other
29	PETROLEUM AND COAL PRODUCTS	382.9	3.6	72.0	.1	289.7	1.8	2.0	13.5
2911	PETROLEUM REFINING	378.1	1.1	(D)	(D)	288.5	.9	1.8	13.5
295	PAVING AND ROOFING MATERIALS	4.5	2.3	(D)	(D)	1.1	.8	.2	(D)
2951	PAVING MIXTURES AND BLOCKS	(D)	1.1	-	-	(D)	(D)	(D)	-
2952	ASPHALT FELTS AND COATINGS	(D)	1.2	(D)	(D)	.4	.1	(D)	(D)
299	MISC. PETROLEUM, COAL PRODUCTS	.4	(D)	-	(D)	.1	(Z)	(Z)	(D)
2992	LUBRICATING OILS AND GREASES	(D)	(D)	-	(D)	(D)	(Z)	(Z)	(D)
2999	PETROLEUM AND COAL PRODUCTS, NEC	(D)	(D)	-	(D)	(D)	(D)	-	(D)

Note: Figures shown for industry groups (3-digit) and major industry groups (2-digit) include data for all component industries, whether or not separate figures are shown for individual industries in the group.

Industries which have been omitted from the table have total water discharge of less than .05 or have data being withheld to avoid disclosure.

- Represents zero. (D) Withheld to avoid disclosing operations of individual companies. N.E.C. Not elsewhere classified.

(Z) less than 50 million gallons.

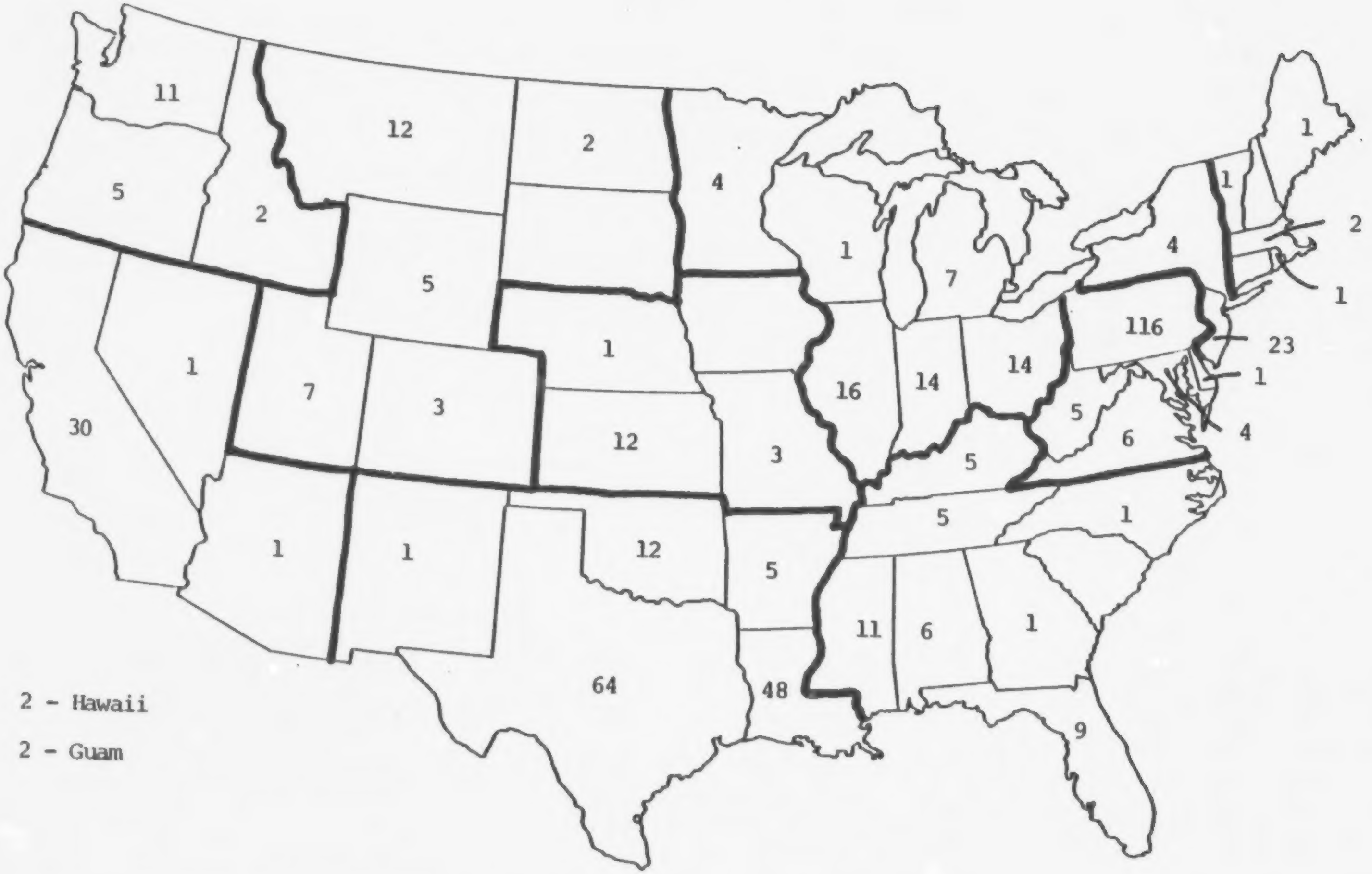
Exhibit C.3-1. (continued)

Exhibit C.3-2. GEOGRAPHICAL DISTRIBUTION OF INDUSTRIAL FACILITIES

(Based on EPA Regions)

SIC Codes: 2911
2992

3 - Alaska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12
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2
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7
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23
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14
16
14
1
30
7
3
12
3
5
5
6
4
1
5
1
1
1
12
5
11
6
1
64
48
9

2 - Hawaii

2 - Guam

Source: Industrial Facilities Discharge Data Base (IFD) EPA-OWRS/MDSD/WQAB.

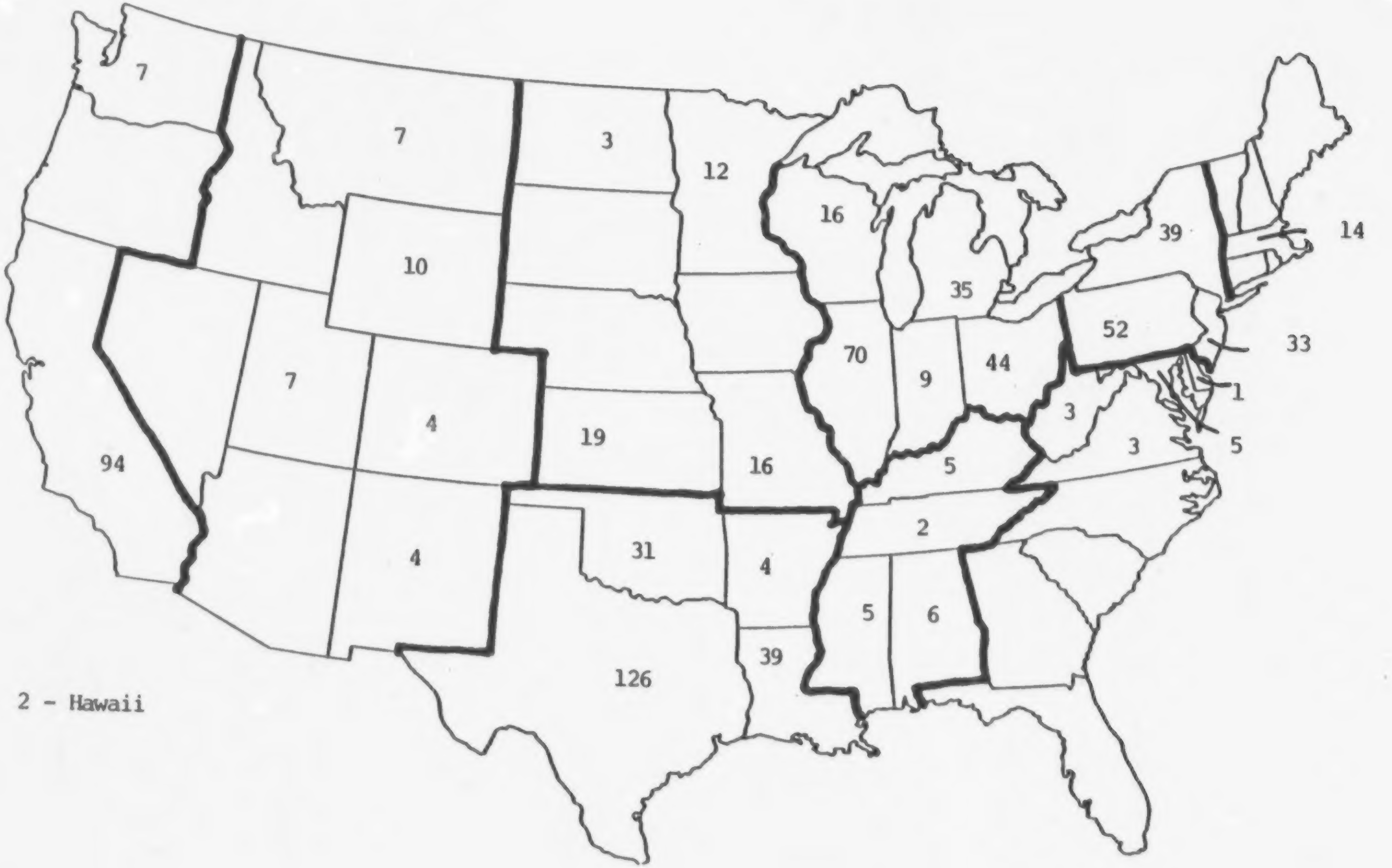
5 - Puerto Rico

1 - Virgin Islands

Exhibit C.3-3. GEOGRAPHICAL DISTRIBUTION OF INDUSTRIAL FACILITIES

(Based on BoC Regions)

SIC Codes: 2911
2992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52
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70
9
44
7
4
1
3
3
5
19
16
5
94
2
31
4
4
5
6
39
126
2 - Hawaii

Source: Bureau of Census, 1980a. (1977 Census of Manufacturers, Industry Series MC77-I-29A, Petroleum and Coal Products).

Exhibit C.3-4.

Environmental Data Summary and Analysis for the Petroleum Refining Industry

Total number of subcategories: 0

Total number of refineries to be regulated:	285
Total number of direct dischargers to be regulated:	182
Total number of indirect dischargers to be regulated:	48
Total number of zero dischargers:	55

Summary of Flow Data (MGY)

	Pretreated Raw	Current	New BAT Option/PSES
Total Direct Flow	113880	113880	71175
Total Indirect Flow	22265	22265	22265
Total Industry Flow for Regulated Plants	136145	136145	93440
Total Other Flow	0	0	0

Number of operating days per year: 365

SIC Code: 2911

Number of direct discharge pipes in IFD data base:	460
Number of direct discharge plants in IFD data base:	351

Statement of Reach/IFD data base adequacy for this industry: There appear to be discrepancies in the number of direct discharging plants and total direct discharge flow between the IFD data base and the EGD data.

	IFD Data Base	EGD Data Base
Total Direct Flow (MGD)	3222.27	312
Number of Direct Discharge Plants	351	182

Source: Versar Inc. 1982. Prepared for EPA-OWRS/MDSD, WQAB.
Data supplied by EPA-OWRS, EGD.

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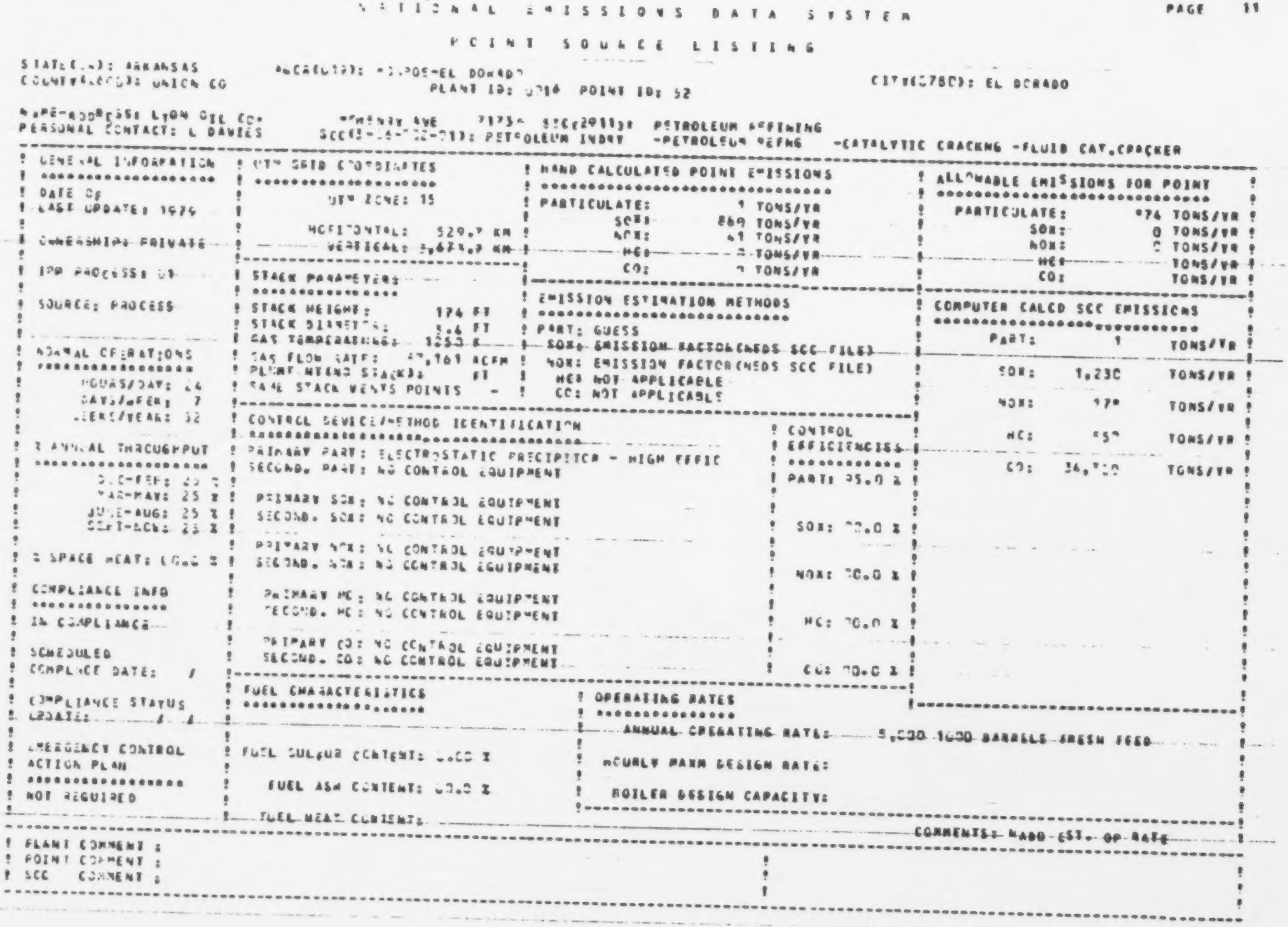
                                  IFD       REPORT           01/22/82                      PAGE   28

   STATE:  MS             ****** INDUSTRIAL FACILITIES IN THE I.F.D. DATABASE ******   VERSAR INCORPORATED
                                                                                        SPRINGFIELD, VIRGINIA 22151
*****************************************************************************************************************
****NPDES #   FACILITY NAME                             DISCHARGE FLOW  CNTY#  CITY#    COUNTY NAME     *****CITY NAME******
DOSN #        LAT/LONG         CODE  TYPE  PIPE#  SIC   **1000 GPD**   RCVG WTR                          CATALOG   UNIT  SEG#
*****************************************************************************************************************
****MS0034878 PLASTIFAX INC-GULFPORT              BAYOU BERNARD         047   31460  HARRISON         GULFPORT
              0302400/0891200   S      S    0001  2865            7.2  D TO BAYOU BERNARD               03-17-00-09   035
****MS0029190 CROSBY CHEMS                        HOBOLOCHITTO CR       109   62140  PEARL RIVER      PICAYUNE
              0303239/0894156   S      S    0001  2865           3000  BL TO HOBOLOCHITTO C             03-18-00-04   004
****MS0001791 FIRST CHEM CORP PASCAGOULA          BAYOU CASOTTE         059   04400  JACKSON          BAYOU CASSOTTE
              0302337/0883008   S      S    0001  2865            450  MISSISSIPPI SND                  03-17-00-09   001
****MS0000442 SOUTHLAND OIL PETROLEUM YAZOO       ROCKY BAY CL 1        163   92430  YAZOO            YAZOO CITY
              0324700/0902810   S      P    0001  2911             .3  ROCKY BAYOU                      08-03-02-06   001
****MS0002984 AMERADA HESS CORP PURVIS            BLACK CR              073          LAMAR
              0311130/0892250   S      S    0001  2911           2160  BLACK C                          03-17-00-07   014
****MS0001686 SOUTHLAND OIL PETROLEUM SAND        MCGILLE CR            067   71110  JONES            SANDERSVILLE
              0314900/0890020   S      P    0001  2911            125  MCGILLE C                        03-17-00-05   017
****MS0001678 SOUTHLAND OIL LUMBERTON             RED CR                073          LAMAR
              0310000/0893000   S      P    0001  2911            100  TR TC RED C                      03-17-00-07   029
****MS0001481 CHEVRON OIL CO                      MISSISSIPPI SOUND     059          JACKSON
              0301904/0882037   S      S    0001  2911          27500  MISSISSIPPI SND                  03-17-00-09   001
****MS0035149 VICKSBURG REFINING INC              MISSISSIPPI RV        149   87100  WARREN           VICKSBURG
              0321900/0905400   S      P    0001  2911                 MISSISSIPPI R                    08-06-01-00   007
****MS0034711 ERGON REFINING-JACKSON              UNKNOWN               049   37830  HINDS            JACKSON
              0322200/0901200   S      D    0001  2911             66  TR OF PEARL R                    03-18-00-02   022
****MS0036498 COMBUSTION INC-ENTERPRISE                                       14850                   KENNER
              0321010/0885028   S      S    0001  2911             42  MCCANTS C                        03-17-00-02   020
****MS0036251 NATCHEZ REFINING CO-NATCHEZ                                     55120                   NATCHEZ
              0313300/0912300   S      P    0001  2911              3  TR TC MISSISSIPPI R              08-06-02-04   001
****MS0035319 QUAKER STATE OIL-VICKSBURG          MISSISSIPPI RV        149   87100  WARREN           VICKSBURG
              0321900/0905400   S      S    0001  2992             29  MISSISSIPPI R                    08-06-01-00   007
****MS0001538 JACKSON OIL PRODUCTS                NEELY CR              121   27050  RANKIN           FLOWOOD
              0320400/0900100   S      P    0001  2992            2.8  NEELY C                          03-18-00-02   022
```

Exhibit C.3-5. Example of IFD Retrieval



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FILE CREATED ON    MONDAY   JANUARY [illegible]
                              N A T I O N A L   E M I S S I O N S   D A T A   S Y S T E M                          PAGE   11

                                            P O I N T   S O U R C E   L I S T I N G

STATE(04): ARKANSAS          AQCR(019): MONROE-EL DORADO
COUNTY(...): UNION CO                       PLANT ID: 0?16  POINT ID: 52                      CITY([illegible]): EL DORADO

NAME-ADDRESS: LYON OIL CO      [illegible]HENRY AVE    7173-  SIC(2911): PETROLEUM REFINING
PERSONAL CONTACT: L DAVIES     SCC(3-06-002-01): PETROLEUM INDRY   -PETROLEUM REFNG   -CATALYTIC CRACKNG -FLUID CAT.CRACKER
--------------------------------------------------------------------------------------------------------------------
! GENERAL INFORMATION   ! UTM GRID COORDINATES          ! HAND CALCULATED POINT EMISSIONS    ! ALLOWABLE EMISSIONS FOR POINT    !
! ******************    ! ********************          ! *******************************    ! ******************************   !
! DATE OF               !          UTM ZONE: 15         ! PARTICULATE:          ? TONS/YR    !   PARTICULATE:       ?74 TONS/YR !
! LAST UPDATE: 1976     !                               !         SOX:        869 TONS/YR    !          SOX:          0 TONS/YR !
!                       !     HORIZONTAL:   529.? KM    !         NOX:         41 TONS/YR    !          NOX:          0 TONS/YR !
! OWNERSHIP: PRIVATE    !       VERTICAL: 3,67?.? KM    !          HC:          ? TONS/YR    !           HC:            TONS/YR !
!                       !-------------------------------!          CO:          ? TONS/YR    !           CO:            TONS/YR !
! IPP PROCESS: 01       ! STACK PARAMETERS              !------------------------------------!----------------------------------!
!                       ! ****************              ! EMISSION ESTIMATION METHODS        ! COMPUTER CALCD SCC EMISSIONS     !
! SOURCE: PROCESS       ! STACK HEIGHT:         174 FT  ! ***************************        ! ****************************     !
!                       ! STACK DIAMETER:       ?.6 FT  ! PART: GUESS                        !     PART:          ?   TONS/YR   !
!-----------------------! GAS TEMPERATURE:     1253 F   !  SOX: EMISSION FACTOR(NEDS SCC FILE)!--------------------------------!
! NORMAL OPERATIONS     ! GAS FLOW RATE:   ??,161 ACFM  !  NOX: EMISSION FACTOR(NEDS SCC FILE)!     SOX:   1,230   TONS/YR     !
! *****************     ! PLUME HEIGHT STACK):      FT  !   HC: NOT APPLICABLE               !                                  !
!      HOURS/DAY: 24    ! SAME STACK VENTS POINTS   -   !   CO: NOT APPLICABLE               !     NOX:     17?   TONS/YR     !
!       DAYS/WEEK: 7    !----------------------------------------------------------------------!                                  !
!      WEEKS/YEAR: 52   ! CONTROL DEVICE/METHOD IDENTIFICATION                ! CONTROL        !      HC:     ?5?   TONS/YR     !
!                       ! **********************************                  ! EFFICIENCIES   !                                  !
! % ANNUAL THROUGHPUT   ! PRIMARY PART: ELECTROSTATIC PRECIPITCR - HIGH EFFIC ! ************   !      CO:  36,??0   TONS/YR     !
! *****************     ! SECOND. PART: NO CONTROL EQUIPMENT                  ! PART: 95.0 %   !                                  !
!       DEC-FEB: 25 %   !                                                     !                !                                  !
!       MAR-MAY: 25 %   !  PRIMARY SOX: NO CONTROL EQUIPMENT                  !                !                                  !
!      JUNE-AUG: 25 %   !  SECOND. SOX: NO CONTROL EQUIPMENT                  !  SOX: ?0.0 %   !                                  !
!      SEPT-NOV: 25 %   !                                                     !                !                                  !
!                       !  PRIMARY NOX: NO CONTROL EQUIPMENT                  !                !                                  !
! % SPACE HEAT: 00.0 %  !  SECOND. NOX: NO CONTROL EQUIPMENT                  !  NOX: ?0.0 %   !                                  !
!                       !                                                     !                !                                  !
! COMPLIANCE INFO       !   PRIMARY HC: NO CONTROL EQUIPMENT                  !                !                                  !
! ***************       !   SECOND. HC: NO CONTROL EQUIPMENT                  !   HC: ?0.0 %   !                                  !
! IN COMPLIANCE         !                                                     !                !                                  !
!                       !   PRIMARY CO: NO CONTROL EQUIPMENT                  !                !                                  !
! SCHEDULED             !   SECOND. CO: NO CONTROL EQUIPMENT                  !   CO: ?0.0 %   !                                  !
! COMPLNCE DATE:   /    !-------------------------------------------------------------------------!----------------------------------!
!                       ! FUEL CHARACTERISTICS               ! OPERATING RATES                                                      !
! COMPLIANCE STATUS     ! ********************               ! ***************                                                      !
! UPDATE:       /  /    !                                    !    ANNUAL OPERATING RATE:     5,000 1000 BARRELS FRESH FEED          !
!                       !                                    !                                                                      !
! EMERGENCY CONTROL     ! FUEL SULFUR CONTENT: 0.00 %        !  HOURLY MAXM DESIGN RATE:                                            !
! ACTION PLAN           !                                    !                                                                      !
! ****************      !    FUEL ASH CONTENT: 00.0 %        !   BOILER DESIGN CAPACITY:                                            !
! NOT REQUIRED          !                                    !----------------------------------------------------------------------!
!                       !    FUEL HEAT CONTENT:                                                       COMMENTS: HAND EST. OP RATE    !
--------------------------------------------------------------------------------------------------------------------
! PLANT COMMENT :                                                              !                                                    !
! POINT COMMENT :                                                              !                                                    !
! SCC   COMMENT :                                                              !                                                    !
--------------------------------------------------------------------------------------------------------------------
```
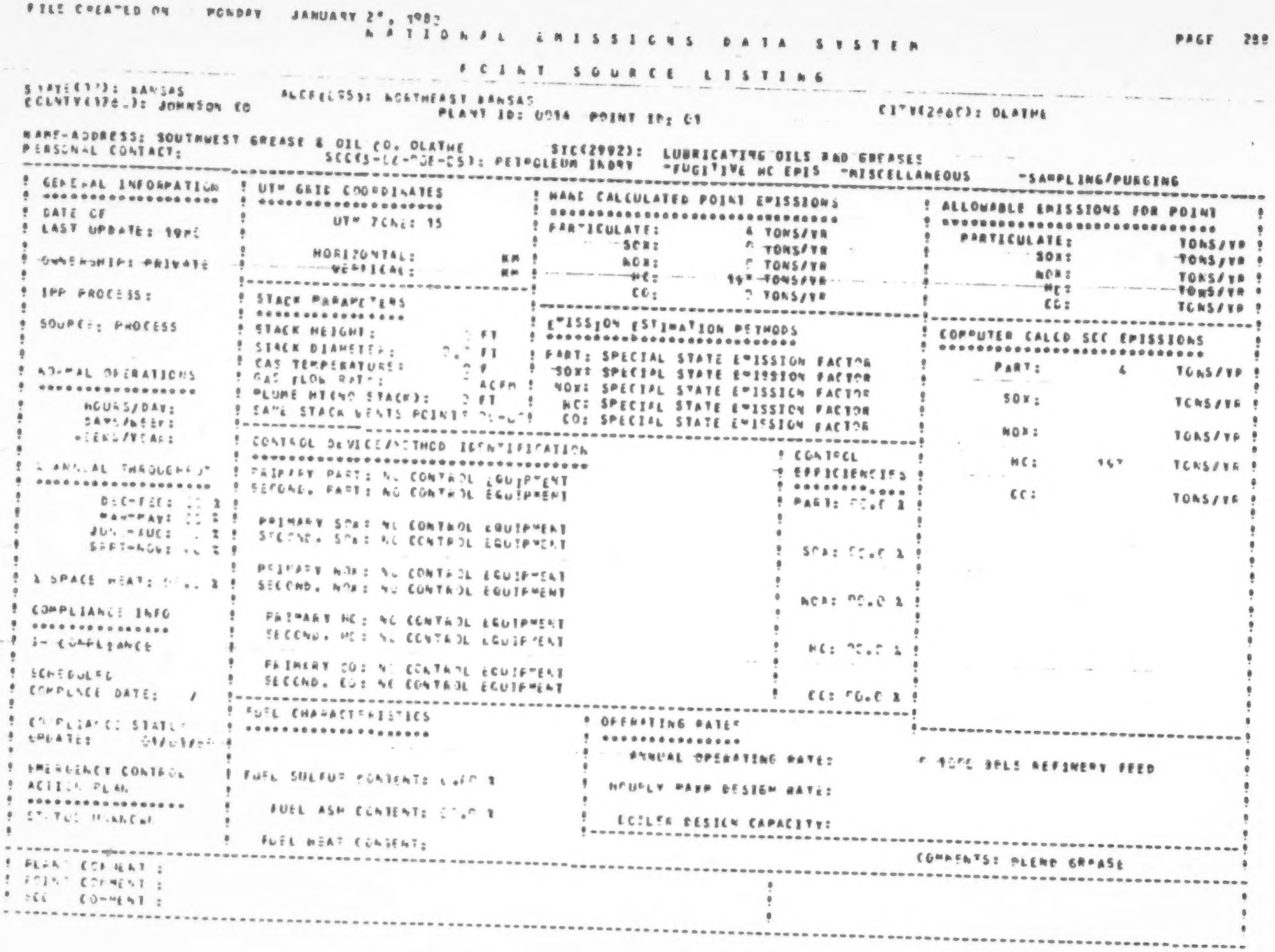

Exhibit C.3-6. Example of NEDS Retrieval



```
FILE CREATED ON   MONDAY   JANUARY 2[illegible], 1982
                 N A T I O N A L   E M I S S I O N S   D A T A   S Y S T E M                    PAGE  298
                           P O I N T   S O U R C E   L I S T I N G
STATE(17): KANSAS            AQCR(095): NORTHEAST KANSAS
COUNTY(176[illegible]): JOHNSON CO               PLANT ID: 0014  POINT ID: 01              CITY(2460): OLATHE

NAME-ADDRESS: SOUTHWEST GREASE & OIL CO. OLATHE          SIC(2992):  LUBRICATING OILS AND GREASES
PERSONAL CONTACT:              SCC(3-06-[illegible]-05): PETROLEUM INDRY  -FUGITIVE HC EMIS  -MISCELLANEOUS    -SAMPLING/PURGING
-------------------------------------------------------------------------------------------------------------------------
! GENERAL INFORMATION   ! UTM GRID COORDINATES         ! NAME CALCULATED POINT EMISSIONS   ! ALLOWABLE EMISSIONS FOR POINT   !
! ********************  ! ********************         ! ******************************    ! ******************************  !
! DATE OF               !         UTM ZONE: 15         ! PARTICULATE:          4 TONS/YR   !   PARTICULATE:          TONS/YR !
! LAST UPDATE: 19[illegible]       !                              !         SOX:          0 TONS/YR   !           SOX:          TONS/YR !
!                       !      HORIZONTAL:          KM !         NOX:          0 TONS/YR   !           NOX:          TONS/YR !
! OWNERSHIP: PRIVATE    !        VERTICAL:          KM !          HC:        197 TONS/YR   !            HC:          TONS/YR !
!                       !------------------------------!          CO:          0 TONS/YR   !            CO:          TONS/YR !
! IPP PROCESS:          ! STACK PARAMETERS             !-----------------------------------!---------------------------------!
!                       ! ****************             ! EMISSION ESTIMATION METHODS       ! COMPUTER CALCD SCC EMISSIONS    !
! SOURCE: PROCESS       ! STACK HEIGHT:           0 FT ! ***************************       ! ****************************    !
!                       ! STACK DIAMETER:       0.0 FT ! PART: SPECIAL STATE EMISSION FACTOR !   PART:        4     TONS/YR  !
! NORMAL OPERATIONS     ! GAS TEMPERATURE:         0 F !  SOX: SPECIAL STATE EMISSION FACTOR !                                !
! *****************     ! GAS FLOW RATE:        0 ACFM !  NOX: SPECIAL STATE EMISSION FACTOR !    SOX:              TONS/YR  !
!      HOURS/DAY:       ! PLUME HT(NO STACK):     0 FT !   HC: SPECIAL STATE EMISSION FACTOR !                                !
!       DAYS/WEEK:      ! SAME STACK VENTS POINTS: [illegible] !   CO: SPECIAL STATE EMISSION FACTOR !    NOX:              TONS/YR  !
!      WEEKS/YEAR:      !------------------------------------------------------------------!                                !
!                       ! CONTROL DEVICE/METHOD IDENTIFICATION         ! CONTROL            !     HC:      197     TONS/YR  !
! % ANNUAL THROUGHPUT   ! ************************************        ! EFFICIENCIES       !                                !
! *****************     ! PRIMARY PART: NO CONTROL EQUIPMENT          ! ************       !     CO:              TONS/YR  !
!       DEC-FEB: [illegible] %  ! SECOND. PART: NO CONTROL EQUIPMENT          ! PART: 00.0 %       !                                !
!       MAR-MAY: [illegible] %  !                                             !                    !                                !
!       JUN-AUG: [illegible] %  ! PRIMARY SOX: NO CONTROL EQUIPMENT           !  SOX: 00.0 %       !                                !
!      SEPT-NOV: [illegible] %  ! SECOND. SOX: NO CONTROL EQUIPMENT           !                    !                                !
!                       !                                             !                    !                                !
! % SPACE HEAT: 00.0 %  ! PRIMARY NOX: NO CONTROL EQUIPMENT           !  NOX: 00.0 %       !                                !
!                       ! SECOND. NOX: NO CONTROL EQUIPMENT           !                    !                                !
! COMPLIANCE INFO       !                                             !                    !                                !
! ***************       ! PRIMARY HC: NO CONTROL EQUIPMENT            !   HC: 00.0 %       !                                !
! 1- COMPLIANCE         ! SECOND. HC: NO CONTROL EQUIPMENT            !                    !                                !
!                       !                                             !                    !                                !
! SCHEDULED             ! PRIMARY CO: NO CONTROL EQUIPMENT            !   CO: 00.0 %       !                                !
! COMPLNCE DATE:   /    ! SECOND. CO: NO CONTROL EQUIPMENT            !                    !                                !
!                       !--------------------------------------------------------------------!--------------------------------!
! COMPLIANCE STATUS     ! FUEL CHARACTERISTICS             ! OPERATING RATES                                                   !
! UPDATES    [illegible]    ! ********************             ! ***************                                                   !
!                       !                                  !    ANNUAL OPERATING RATE:        [illegible] BBLS REFINERY FEED          !
! EMERGENCY CONTROL     ! FUEL SULFUR CONTENT: 0.00 %      !                                                                   !
! ACTION PLAN           !                                  !  HOURLY MAXM DESIGN RATE:                                         !
! *****************     !   FUEL ASH CONTENT: 00.0 %       !                                                                   !
! STATUS UNKNOWN        !                                  !   BOILER DESIGN CAPACITY:                                         !
!                       !  FUEL HEAT CONTENT:              !-------------------------------------------------------------------!
-------------------------------------------------------------------------------------------------------------------------------
! PLANT COMMENT :                                                                        COMMENTS: BLEND GREASE              !
! POINT COMMENT :                                               !                                                             !
! SCC   COMMENT :                                               !                                                             !
-------------------------------------------------------------------------------------------------------------------------------
```

Exhibit C.3-6. Example of NEDS Retrieval (cont'd)

Appendix C
Part 4 - Retrievals from Other Monitoring Data Bases

```
POINT SOURCE RECREATED 09/C2/61
POINT SOURCE MANUALLY UPDATED 09/01/81                                                                       RUN DATE (9/16/81
                                                                                                             PAGE    21
                                 H A Z A R D O U S   A N D   T R A C E   E M I S S I O N S   S Y S T E M
                                                  P O I N T   S O U R C E   L I S T I N G

STATE(45): TEXAS              AQCR(216): METROPOLITAN HOUSTON-GALVESTON
COUNTY(1860): FORT BEND CO                       PLANT ID: 0005  POINT ID: 01                   CITY(4410): RICHMOND

NAME ADDRESS: HOUSTON LGT&PWR  PARISH PLANT  RICHMOND   SIC(4911):  ELECTRIC SERVICES
PERSONAL CONTACT: D E SIMMONS   SCC(1-01-003-01): EXTCOMB BOILER     ELECTRIC GENERATN LIGNITE          PULVERIZED COAL
--------------------------------------------------------------------------------------------------------------------------
! GENERAL INFORMATION      ! NORMAL OPERATIONS   ! % ANNUAL THROUGHPUT  ! UTM GRID COORDINATES    !   STACK PARAMETERS          !
! ******************       ! ****************    ! ******************   ! *******************     !   ****************          !
! YEAR OF RECORD: 1979     !  HOURS/DAY:  24     !   DEC-FEB:  23 %     !  UTM ZONE:   15         ! HEIGHT:               168 FT  !
! OWNERSHIP(U):            !                     !   MAR-MAY:  28 %     !                         ! DIAMETER:            10.5 FT  !
!  UTILITY                 !  DAYS/WEEK:   7     !   JUNE-AUG: 31 %     !  HORIZONTAL: 244.8   KM ! TEMPERATURE:          266 F   !
! BOILER DESIGN CAP:       !                     !   SEPT-NOV: 18 %     !                         ! FLOW RATE:         227000 ACFM!
!  1669 MILLION BTU/HR     !  WEEKS/YEAR: 48     !                      !  VERTICAL:   3264.5  KM ! PLUME HEIGHT:           0 FT  !
! 1PP PROCESS: 00          !                     !                      !                         ! PT/COMMON STACK:    00-00     !
!-------------------------------------------------------------------------------------------------------------------------!
!  OPERATING RATES IN  TONS BURNED                      !                   CONTROL DEVICE/METHOD IDENTIFICATION           !
!  ***********************************************      !                   ************************************           !
!    ANNUAL OPERATING RATE:       [redacted]            !        PRIMARY  PB    : NO EQUIPMENT                            !
!    MAXIMUM HOURLY DESIGN RATE:                        !        SECOND   PB    : NO EQUIPMENT                            !
!    AVERAGE HOURLY RATE:                               !        TERTIARY PB    : NO DATA                                 !
!    OPERATING RATE AFTER 10 YEARS:      % INCREASE     !        PRIMARY        :                                         !
!    OPERATING RATE AFTER 20 YEARS:      % INCREASE     !        SECOND         :                                         !
!-------------------------------------------------------!        TERTIARY       :                                         !
!                  ***COMMENTS***                       !        PRIMARY        :                                         !
!PLANT :                                                !        SECOND         :                                         !
!POINT :                                                !        TERTIARY       :                                         !
!SCC   :                                                !        PRIMARY        :                                         !
!PB    :                                                !        SECOND         :                                         !
!      :                                                !        TERTIARY       :                                         !
!      :                                                !        PRIMARY        :                                         !
!      :                                                !        SECOND         :                                         !
!      :                                                !        TERTIARY       :                                         !
!-------------------------------------------------------------------------------------------------------------------------!
! POLLUTANT          ANALYSIS METHOD         EMISSION ESTIMATION METHODS   ESTIMATED EMISSIONS    CALCULATED EMISSIONS     !
! *********          ***************         ***************************   *******************    ********************     !
!  PB                                              [redacted]                          TONS/YR    18.702   TONS/YR         !
!                                                                                      TONS/YR             TONS/YR         !
!                                                                                      TONS/YR             TONS/YR         !
!                                                                                      TONS/YR             TONS/YR         !
!                                                                                      TONS/YR             TONS/YR         !
!-------------------------------------------------------------------------------------------------------------------------!
! POLLUTANT   EMISSION PARAMETER   EMISSION PARAM   CALCULATED CONTROL    MANUAL INPUT CNTRL    CONTROL EQUIPMENT          !
! *********        CONTENT          EST METHOD      EQUIP EFFICIENCIES    EQUIP EFFICIENCIES    EFFICIENCY EST MTHD        !
!  PB         ****************   **************   ******************    ******************    ******************         !
!                                                        .00                                                              !
!                                                                                                                          !
---------------------------------------------------------------------------------------------------------------------------
```

HATREMS (POINT SOURCE) EXHIBIT C.4-1

```
POINT SOURCE RECREATED 09/02/81
POINT SOURCE MANUALLY UPDATED 09/01/81
                                                                                              RUN DATE 09/16/81
                                                                                              PAGE    22
                          H A Z A R D O U S   A N D   T R A C E   E M I S S I O N S   S Y S T E M
                                          P O I N T   S O U R C E   L I S T I N G
STATE(45): TEXAS            AQCR(216): METROPOLITAN HOUSTON-GALVESTON
COUNTY(1860): FORT BEND CO                    PLANT ID: 0005  POINT ID: 01                  CITY(4410): RICHMOND

NAME ADDRESS: HOUSTON LGT&PWR  PARISH PLANT  RICHMOND   SIC(4911):  ELECTRIC SERVICES
PERSONAL CONTACT: D E SIMMONS   SCC(1-01-004-01): EXTCOMB BOILER     ELECTRIC GENERATN  RESIDUAL OIL      GRADE 6 NORMAL FI
------------------------------------------------------------------------------------------------------------------------
! GENERAL INFORMATION     ! NORMAL OPERATIONS    ! % ANNUAL THROUGHPUT    ! UTM GRID COORDINATES     !  STACK PARAMETERS        !
! *****************       ! *****************    ! ******************     ! ******************       !  ***************         !
! YEAR OF RECORD: 1979    !  HOURS/DAY:  24      !  DEC-FEB:  23 %        ! UTM ZONE:   15           ! HEIGHT:           168 FT  !
! OWNERSHIP(U):           !                      !  MAR-MAY:  28 %        !                          ! DIAMETER:        10.5 FT  !
!  UTILITY                !  DAYS/WEEK :   7     !  JUNE-AUG: 31 %        !                          ! TEMPERATURE:      266 F   !
! BOILER DESIGN CAP:      !                      !  SEPT-NOV: 18 %        ! HORIZONTAL: 244.8    KM! ! FLOW RATE:     227000 ACFM!
!  1669 MILLION BTU/HR    !  WEEKS/YEAR: 48      !                        !                          ! PLUME HEIGHT:       0 FT  !
! IPP PROCESS: 00         !                      !                        ! VERTICAL:   3264.5   KM! ! PT/COMMON STACK:  00-00   !
!------------------------------------------------------------------------------------------------------------------------!
! OPERATING RATES IN  1000GALLONS BURNED            !                                                                    !
! ***********************************************   !             CONTROL DEVICE/METHOD IDENTIFICATION                   !
!   ANNUAL OPERATING RATE:                          !             ************************************                   !
!   MAXIMUM HOURLY DESIGN RATE:   [redacted]        !      PRIMARY  PB   : NO EQUIPMENT                                  !
!   AVERAGE HOURLY RATE:                            !      SECOND   PB   : NO EQUIPMENT                                  !
!   OPERATING RATE AFTER 10 YEARS:    % INCREASE    !      TERTIARY PB   : NO DATA                                       !
!   OPERATING RATE AFTER 20 YEARS:    % INCREASE    !      PRIMARY       :                                               !
!---------------------------------------------------!      SECOND        :                                               !
!                  ***COMMENTS***                   !      TERTIARY      :                                               !
!PLANT :                                            !      PRIMARY       :                                               !
!POINT :                                            !      SECOND        :                                               !
!SCC   :                                            !      TERTIARY      :                                               !
!PB    :                                            !      PRIMARY       :                                               !
!      :                                            !      SECOND        :                                               !
!      :                                            !      TERTIARY      :                                               !
!      :                                            !      PRIMARY       :                                               !
!      :                                            !      SECOND        :                                               !
!      :                                            !      TERTIARY      :                                               !
!------------------------------------------------------------------------------------------------------------------------!
! POLLUTANT          ANALYSIS METHOD          EMISSION ESTIMATION METHODS    ESTIMATED EMISSIONS     CALCULATED EMISSIONS    !
! *********          ***************          ***************************    *******************     ********************    !
!  PB                                         [redacted]                                                                     !
!                                                                                      TONS/YR          0.001  TONS/YR       !
!                                                                                      TONS/YR                 TONS/YR       !
!                                                                                      TONS/YR                 TONS/YR       !
!                                                                                      TONS/YR                 TONS/YR       !
!------------------------------------------------------------------------------------------------------------------------!
!                    EMISSION PARAMETER                                                                                  !
! POLLUTANT              CONTENT          EMISSION PARAM     CALCULATED CONTROL    MANUAL INPUT CNTRL    CONTROL EQUIPMENT   !
! *********         *****************       EST METHOD       EQUIP EFFICIENCIES    EQUIP EFFICIENCIES    EFFICIENCY EST MTHD !
!  PB                                    **************      ******************    ******************    ******************* !
!                                                                   .00                                                      !
!                                                                                                                            !
------------------------------------------------------------------------------------------------------------------------------
```

EXHIBIT C.4.1 (Cont'd)

```
                                    HAZARDOUS AND TRACE EMISSIONS SYSTEM
                                    ************************************

                                     ENVIRONMENTAL PROTECTION AGENCY
                                     *******************************

      COUNTY     EMISSIONS REPORT                                                     RUN DATE: WEDNESDAY SEPTEMBER 16, 1981
      ***************************                                           AREA EMISSIONS AS OF:    MONDAY    AUGUST 17, 1981
      FORT BEND                                                            POINT EMISSIONS AS OF: WEDNESDAY SEPTEMBER  2, 1981
      TEXAS

                                    PB
                              **************    **************    **************    **************    **************
                                 TONS / YR         TONS / YR         TONS / YR         TONS / YR         TONS / YR
FUEL COMBUSTION
***************

  EXTERNAL COMBUSTION

    RESIDENTIAL FUEL (AREA)

      ANTHRACITE COAL                 0
      BITUMINOUS COAL                 0
      DISTILLATE OIL                  0
      RESIDUAL OIL                    0
    TOTAL (RESIDENTIAL)               0

    ELEC GENERATION (POINT)

      LIGNITE                        19
      RESIDUAL OIL                    0
    TOTAL (ELECT GEN)                19

    INDUSTRIAL FUEL

      ANTHRACITE COAL
        AREA SOURCES                  0
      BITUMINOUS COAL
        AREA SOURCES                  0
      RESIDUAL OIL
        AREA SOURCES                  0
      DISTILLATE OIL
        AREA SOURCES                  0
    TOTAL (INDUSTRIAL)
      AREA SOURCES                    0

    COMM-INSTITUTIONAL FUEL

      ANTHRACITE COAL
        AREA SOURCES                  0
      BITUMINOUS COAL
        AREA SOURCES                  0
      RESIDUAL OIL
        AREA SOURCES                  0
        AREA SOURCES                  0
    TOTAL (COMM-INST)
      AREA SOURCES                    0
```

HATREMS (AREA SOURCE) EXHIBIT C.4-2

```
   TOTAL (EXTERNAL COMBUSTION)
      AREA SOURCES                          0
      POINT SOURCES                        19

TOTAL (FUEL COMBUSTION)

   AREA SOURCES                             0
   POINT SOURCES                           19

INDUSTRIAL PROCESS (POINT)
**************************

   SECONDARY METALS                         2
TOTAL (INDUSTRIAL)                          2

SOLID WASTE DISPOSAL
********************

   RESIDENTIAL (AREA)

      ON SITE INCINERATION                  0
   TOTAL (RESIDENTIAL)                      0

   COMMERCIAL-INSTITUTIONAL

      ON SITE INCINERATION
         AREA SOURCES                       0
   TOTAL (COMM-INST)
      AREA SOURCES                          0

   INDUSTRIAL

      ON SITE INCINERATION
         AREA SOURCES                       0
   TOTAL (INDUSTRIAL)
      AREA SOURCES                          0

TOTAL (SOLID WASTE DISP)

   AREA SOURCES                             0

TRANSPORTATION (AREA)
*********************

   LAND VEHICLES

      GASOLINE

         LIGHT DUTY VEHICLES               24
         HEAVY DUTY VEHICLES                1
         OFF HIGHWAY                        1
      TOTAL (GASOLINE)                     27

TOTAL (TRANSPORTATION)                     27
```

EXHIBIT C.4-2 (Cont'd)

```
GRAND TOTAL
***********

   AREA SOURCES                                 28
   POINT SOURCES                                21

TOTAL                                           49
```

EXHIBIT C.4-2 (Cont'd)

```
STATS-001          ENVIRONMENTAL ASSESSMENT DATA SYSTEMS                    PAGE:      001
                        CHEMICAL STATISTICS REPORT                          DATE: 08/04/82
                   -------------------------------------

DATA BASE: LEDS    SOURCE TYPE:     TEXTILES              PROCESS TYPE:    FINISHING
                   SAMPLE LOCATION: O
                   EPA CHEMICAL LIST CODE: P WATER PRIORITY POLLUTANTS

                                               NUMBER     NUMBER     CHEMICAL POLLUTANT CONCENTRATION (UG/L)
  POLLUTANT                                      OF         OF       --------  --------  --------  --------  --------
  PREFERRED NAME                               TEST SERIES SAMPLES   MINIMUM   MAXIMUM   MEAN      MEDIAN    STD DEV
  ---------                                   ----------- ---------  --------  --------  --------  --------  --------
   ANTIMONY                                         11        11     8.000-01  7.400+01  1.435+01  3.740+01  2.126+01
   ARSENIC                                           2         2     4.000+00  6.000+00  5.000+00  5.000+00  1.155+00
   BERYLLIUM                                         1         1     1.000-01  1.000-01  1.000-01  1.000-01  ********
   BROMODICHLOROMETHANE                              1         1     1.540+02  1.540+02  1.540+02  1.540+02  ********
   CADMIUM                                           3         3     5.000-01  1.300+01  6.500+00  6.750+00  5.604+00
   CHLOROBENZENE                                     2         2     3.500+00  8.800+01  4.575+01  4.575+01  5.975+01
   CHLOROFORM (TRICHLOROMETHANE)                     3         3     6.900+00  1.800+03  7.960+02  9.034+02  9.157+02
   CHROMIUM                                          9         9     2.000-01  1.800+03  2.289+02  9.001+02  5.742+02
   COPPER                                           12        12     2.000+00  1.700+02  4.050+01  8.600+01  4.984+01
   DIETHYL PHTHALATE                                 1         1     1.000+00  1.000+00  1.000+00  1.000+00  ********
   DI-N-BUTYL PHTHALATE                              2         2     3.600+00  5.840+01  3.100+01  3.100+01  3.875+01
   DI-2-ETHYLHEXYL PHTHALATE                        13        13     2.000+00  2.310+02  4.517+01  1.165+02  6.763+01
   ETHYL BENZENE                                     5         5     7.000-01  2.780+02  6.402+01  1.393+02  1.131+02
   HEPTACHLOR                                        1         1     1.550+00  1.550+00  1.550+00  1.550+00  ********
   LEAD                                              3         3     1.000+00  1.200+02  5.933+01  6.050+01  5.953+01
   MERCURY                                           4         4     5.000-01  7.000-01  5.500-01  6.000-01  1.000-01
   NAPHTHALENE                                       3         3     5.000-01  2.550+02  9.250+01  1.277+02  1.411+02
   NICKEL                                            8         8     4.000+00  1.400+02  7.050+01  7.200+01  5.245+01
   N-NITROSODIPROPYLAMINE                            1         1     1.890+02  1.890+02  1.890+02  1.890+02  ********
   PHENOL                                           14        14     1.800-01  2.320+02  4.104+01  1.161+02  5.866+01
   PYRENE                                            1         1     1.000-01  1.000-01  1.000-01  1.000-01  0.000
   SILVER                                            2         2     8.000+00  9.500+01  5.150+01  5.150+01  5.023+01
   TOLUENE                                          10        10     1.670+00  1.400+03  2.136+02  7.008+02  4.295+02
   TRANS-1,3-DICHLOROPROPENE                         1         1     8.900-01  8.900-01  8.900-01  8.900-01  0.000
   TRICHLOROFLUOROMETHANE                            2         2     8.930+01  2.140+03  1.115+03  1.115+03  1.450+03
   ZINC                                             15        15     8.000+01  3.840+04  3.247+03  1.924+04  9.683+03
   1,2-DICHLOROBENZENE                               2         2     1.000+00  6.000+00  3.500+00  3.500+00  3.536+00
   1,2,4-TRICHLOROBENZENE                            3         3     1.800+01  9.160+02  3.267+02  4.670+02  4.567+02
   1,4-DICHLOROBENZENE                               2         2     5.000-02  1.500+00  7.750-01  7.750-01  1.025+00
```

ENVIRONMENTAL ASSESSMENT DATA SYSTEM

EXHIBIT C-4.3

```
STATS-003           ENVIRONMENTAL ASSESSMENT DATA SYSTEMS          PAGE:      001
                     FPEIS PARTICLE DISTRIBUTION SUMMARY           DATE: 08/04/82
                    -----------------------------------

               SOURCE TYPE:     GLASS              PRODUCT/DEVICE:  BOTTLES
               SAMPLE LOCATION: I

 PARTICLE    NUMBER      NUMBER     CUMULATIVE MASS CONCENTRATION (UG/DNM3)
 DIAMETER      OF          OF       --------  --------  --------  --------  -----
  (UM)     TEST SERIES  SAMPLES     MINIMUM   MAXIMUM    MEAN     MEDIAN    STD DEV
 --------  ----------- ----------   --------  --------  --------  --------  --------
  20.000        2           3       1.640+06  1.740+06  1.700+06  1.690+06  5.292+04
  15.000        2           3       1.560+06  1.660+06  1.623+06  1.610+06  5.508+04
  10.000        2           3       1.450+06  1.590+06  1.530+06  1.520+06  7.211+04
   5.000        2           3       1.410+06  1.560+06  1.483+06  1.485+06  7.506+04
   2.500        2           3       1.390+06  1.540+06  1.447+06  1.465+06  8.145+04
   1.250        2           3       1.060+06  1.500+06  1.297+06  1.280+06  2.219+05
   1.000        2           3       9.030+05  1.480+06  1.231+06  1.191+06  2.965+05
    .625        2           3       5.810+05  1.450+06  1.090+06  1.015+06  4.534+05
```

EXHIBIT C-4.3 (Cont'd)

```
                              ENVIRONMENTAL ASSESSMENT DATA SYSTEMS                            PAGE        1
                                    FPEIS SPECIAL SERIES REPORT                 SERIES FORM 1   DATE 07/30/82
                              -------------------------------

FPEIS TEST SERIES NO:    233  DESCRIBES SAMPLING AT SITE FROM 03/21/78 TO 03/21/78 BY KVB, INC.

                    SPONSOR ORGANIZATION:    CALIFORNIA AIR RESOURCES BOARD
                    CONTRACT NUMBER:         A6-191-30                        PURPOSE OF TEST: EAS
                    TASK/DIRECTIVE NUMBER:   000

 SOURCE DESCRIPTION------------------------------

               SOURCE CATEGORY:          METALS                   SOURCE NAME:   CONFIDENTIAL
               SOURCE TYPE:              SECONDARY FERROUS        SITE NAME:
               PRODUCT/DEVICE:           STEEL                    ADDRESS:
               PROCESS TYPE:             OPEN HEARTH                             LOS ANGELES        ,CA     00000
               DESIGN PROCESS RATE:        8260    KG/HR          NPDES NUMBER:
               FEED MATERIAL CATEGORY:    MTL SCRAP
               SIC CODE:                   3312

 EADS WASTE STREAM DATA BASES--------------------

               WASTE STREAM DATA FROM OTHER MEDIA WHICH WERE COLLECTED CONCURRENTLY WITH THIS TEST SERIES
               ARE AS FOLLOWS(TEST SERIES NUMBER-TSN):
                    LEDS TSN:          GEDS TSN: 00085    SDDS TSN:

 REFERENCE REPORT--------------------------------

               TITLE
               AUTHOR
               SPONSOR REPORT NUMBER    NTIS NUMBER          PUBLICATION DATE
               -----------------------------------------------------------------
               FINE PARTICLE EMISSIONS FROM STATIONARY AND MISCELLANEOUS SOURCES
               IN THE SOUTH COAST AIR BASIN.
               TABACK H.J.
               KVB REPORT 5806-783      PB 293 923/AS        FEBRUARY 1979

 TEST SERIES COMMENTS----------------------------
                  PROGRAM OBJECTIVES TO INVENTORY TSP EMISSIONS,TO PREPARE A COM-
                  PREHENSIVE INVENTORY OF EMISSIONS(I.E. BY SIZE DISTRIBUTION AND
                  CHEMICAL COMPOSITION),AND TO DESCRIBE ALT. METHODS OF CONTROL.
```

ENVIRONMENTAL ASSESSMENT DATA SYSTEM

EXHIBIT C.4-4

```
FPEIS TEST SERIES NO: 00233    STREAM NO: 01                                                                PAGE        2
                                                                                              SERIES FORM 2    DATE 07/30/82

  EFFLUENT STREAM DESIGN CHARACTERISTICS-----------

        STREAM NAME: FURNACE EXHAUST

        STREAM DESIGN DATA AT SOURCE

               MOISTURE CONTENT=      PCT   MASS/VOLUMETRIC FLOW RATE=                    VELOCITY=      M/S

               TEMPERATURE=      C    PRESSURE=       CM HG      STACK HEIGHT=   30.5 METERS

        COMMENTS:        DESIGN STREAM CHARACTERISTICS UNKNOWN


  CONTROL/TREATMENT SYSTEM CHARACTERISTICS-----

        DEVICE  01

               GENERIC SYSTEM TYPE:       ESP                               DEVICE CLASS:      CONVENTIONAL
               DESIGN TYPE:               TWO-STAGE                         COMMERICAL NAME:   HI-VOLTAGE
               SPECIFIC PROCESS/DEVICE:   HIGH INTENSITY ION                MANUFACTURER:      RESEARCH-COTTRELL

               DEVICE/PROCESS DESIGN PARAMETERS:  01   HALFWAVE RECTIFICATION            55.00E+03  NONE
                                                  02   PLATES ON EACH SIDE               14.00E+00  NONE
                                                  03   MILLIAMPS                          2.00E-01  AMPS
```

EXHIBIT C.4-4 (Cont'd)

```
FPEIS TEST SERIES NO: 00233    STREAM NO: 01    TEST ID NO: 001                                        PAGE        3
                                                                                    SERIES FORM 3    DATE 07/30/82

  SOURCE/PROCESS CONDITIONS DATA-----------------

       TEST CONDITIONS-----

              TEST DATE: 03/21/78    TEST START TIME: 1133   FINISH TIME: 1434

              SOURCE OPERATING MODE:  CONTINUOUS, 8 HOUR HEATS           PERCENT OF DESIGN CAPACITY= 100.0

       COMMENTS:
```

EXHIBIT C.4-4 (Cont'd)

```
FPEIS TEST SERIES NO: 00233    STREAM NO: 01    TEST ID NO: 001    SEQ. NO: 1                          PAGE        4
                                                                                         SERIES FORM 4   DATE 07/30/82

  FUELS AND FEEDSTOCKS CHARACTERISTICS-----------

       SOURCE FUEL/FEED MATERIAL:  METAL SCRAP                      FEED MATERIAL RATE:  8260 KG/HR

       NAME OF ANALYTICAL LABORATORY:                                             QA AUDIT CODE:

       SAMPLE MASS:               SAMPLE VOLUME:

    CHARACTERISTICS:
                                                                  HIGH      LOW      DETECTION
                                                               DETECTION DETECTION    LIMIT
       PARAMETER     ANALYTICAL METHOD                           LIMIT     LIMIT      UNITS      VALUE     UNITS/TEXT
       ------------  --------------------------------------  --------- ---------  --------  ----------  ------------------
       LIMESTONE     NOT SPECIFIED                                                          2.90E+03  KG/HR
       COKE          NOT SPECIFIED                                                          2.20E+03  KG/HR
       SCRAP         NOT SPECIFIED                                                          7.75E+04  KG/HR
```

EXHIBIT C.4-4 (Cont'd)

```
FPEIS TEST SERIES NO: 00233    STREAM NO: 01    TEST ID NO: 001    SEQ. NO: 2
                                                                                   PAGE        5
                                                                   SERIES FORM 4   DATE 07/30/82

  FUELS AND FEEDSTOCKS CHARACTERISTICS-----------

        SOURCE FUEL/FEED MATERIAL:  FUEL OIL                  FEED MATERIAL RATE:  1320 KG/HR

        NAME OF ANALYTICAL LABORATORY:                                  QA AUDIT CODE:

        SAMPLE MASS:             SAMPLE VOLUME:
```

EXHIBIT C.4-4 (Cont'd)

```
FPEIS TEST SERIES NUMBER: 00233   STREAM NO: 001   TEST ID NO: 001                                              PAGE        6
                                                                                              SERIES FORM C6    DATE 07/30/82

PARTICLE SIZE SUMMARY-----------------------
                                                                PARTICLE DIAMETER IN MICROMETERS
              SAMPLE LOCATIONS         UG/DNM3
SAMPLE NO.  DEVICE      SYSTEM                       20.0      15.0      10.0       5.0       2.5      1.25       1.0     0.625
----------  -----------------                      --------  --------  --------  --------  --------  --------  --------  --------
   01       INLET         I       CUM MASS CONC    4.64E+06  4.24E+06  3.73E+06  3.48E+06  3.39E+06  2.87E+06  2.61E+06  2.03E+06
                                  DM/DLOG D        3.34E+06  3.10E+06  2.36E+06  1.79E+05  7.18E+05  2.60E+06  2.77E+06  2.82E+06
   02       OUTLET        O       CUM MASS CONC    4.72E+05  3.70E+05  2.65E+05  2.22E+05  1.81E+05  1.26E+05  1.08E+05  7.52E+04
                                  DM/DLOG D        9.17E+05  7.30E+05  3.94E+05  9.08E+04  1.78E+05  1.84E+05  1.75E+05  1.46E+05
```

EXHIBIT C.4-4 (Cont'd)

```
FPEIS TEST SERIES NO: 00233    STREAM NO: 01    TEST ID NO: 001    SAMPLE NO: 01                        PAGE         7
                                                                                         SERIES FORM 6    DATE 07/30/82

 SAMPLING ACTIVITY DESCRIPTION-------------------
      MEASUREMENT INSTRUMENT/METHOD TYPE: I  NAME: OTHER CYCLONES                    SAMPLING START TIME: 1133  DURATION: 177 MIN
      SAMPLING CONDITIONS-- MASS/VOLUMETRIC FLOWRATE=     9.5 M3/SEC   FLOWRATE METHOD: PITOT TUBE             TEMPERATURE=  252 C
                                 MOISTURE CONTENT= 9.8 PCT    VELOCITY=   7.2 M/SEC   PRESSURE=  99 MM HG
                                 SAMPLE DENSITY= 1.0 G/CM3   DENSITY DETERMINATION: ASSUMED


      DEVICE SAMPLING LOCATION=INLET    DEVICE/PROCESS NUMBER=   1 SAMPLING LOCATION DESCRIPTION: 2.5 M FROM ESP INLET
      SYSTEM SAMPLING LOCATION= INLET OR UNCONTROLLED      CORRESPONDING SAMPLE NUMBER:
      VOLUME OF SAMPLE COLLECTED=   4.90 M3    TOTAL MASS OF SAMPLE COLLECTED=    2.28  G
      MEASUREMENT INSTRUMENT:  TEMPERATURE=  206 C   INLET PRESSURE= 101 MM HG FLOW RATE=   50.1  L/MIN
      ESTIMATED TIME BETWEEN SAMPLING AND CHEM ANALYSIS:      DAYS          -SAMPLING AND RADIOASSAY:      DAYS
      COLLECTION SURFACE/SUBSTRATE:
      PERCENT ISOKINETIC SAMPLING=  98    GAS ANALYSIS (PCT BY WEIGHT)-- CO2= 11.50   CO=          O2=  8.50   N2= 80.00
      OTHER TRACE GASES (IN PPM): NOX-450,SO2-40,NO2-70                                        DILUTION FACTOR=    1.0
      PARTICLE MEASUREMENTS WERE MADE ON THE BASIS OF MASS    UPPER BOUNDARY DIAMETER=   30.00 UM


      PARTICLE DIAMETERS ARE DEFINED ACCORDING TO THE FOLLOWING DEFINITION:  CLASSIC AERODYNAMIC
      PARTICLE DIAMETERS WERE DETERMINED FROM CALIBRATION



 COMMENTS ON THE SAMPLING ACTIVITY---------------
                              OF TOTAL MASS, 165 MG IS INORGANIC & 54.0 MG IS ORGANIC CAUGHT
                              IN IMPINGERS, GEDS 85.
                              THREE CYCLONES WERE FABRICATED AND USED IN SERIES WITH A
                              JOY TRAIN.
```

EXHIBIT C.4-4 (Cont'd)

```
FPEIS TEST SERIES NO: 00233    STREAM NO: 01    TEST ID NO: 001    SAMPLE NO: 01                              PAGE        8
                                                                                              SERIES FORM 7    DATE 07/30/82

  EFFLUENT STREAM DESIGN CHARACTERISTICS-----------

        COMPONENT
        NO  NAME          DESCRIPTION                                          VALUE
        --  ------------  ---------------------------------------------------  -----------------------------------

         1  PROBE + 10
                          STAGE/FILTER CUT SIZE:                                 8.30     UM
                          STAGE WEIGHT:                                         4.97E+02 MG
                          COMPONENT (ALIQUOT) MASS/VOLUME:                      269.000  MG
                          CHEMICAL ANALYSIS LABORATORY NAME:                   ARMAME

         2  3 UM CYCLONE
                          STAGE/FILTER CUT SIZE:                                 1.90     UM
                          STAGE WEIGHT:                                         9.91E+01 MG

         3  1 UM CYCLONE
                          STAGE/FILTER CUT SIZE:                                  .60     UM
                          STAGE WEIGHT:                                         5.85E+02 MG
                          COMPONENT (ALIQUOT) MASS/VOLUME:                      585.000  MG

         4  FILTER
                          STAGE/FILTER CUT SIZE:                                  .01     UM
                          STAGE WEIGHT:                                         8.83E+02 MG
                          COMPONENT (ALIQUOT) MASS/VOLUME:                      883.000  MG

PARTICLE SIZE TABLE---------

  STAGE #                              1          2          3          4
                                   --------   --------   --------   --------
  D50(MICRONS)                         8.30       1.90        .60        .01
  STAGE WEIGHTS(MILLIGRAMS)        4.97E+02   9.91E+01   5.85E+02   8.83E+02
  MICROGRAMS/DNCM/STAGE            1.12E+06   2.23E+05   1.31E+06   1.98E+06
  NUMBER/DNCM/STAGE                5.43E+11   6.79E+12   2.06E+15   4.96E+16
  CUM. %MASS<D50                      75.92      71.12      42.78
  CUM. MICROGRAMS/ACM<D50          1.77E+05   1.66E+05   9.96E+04   0.00E-0
  CUM. MICROGRAMS/DNCM<D50         3.52E+06   3.30E+06   1.98E+06   0.00E-0
  GEOM D50                         1.58E+01   3.97E+00   1.07E+00   4.24E-01
  DM/DLOGD-(MICRONS)               2.00E+06   3.46E+05   2.63E+06   1.12E+06
  DN/LOGD-(NUMBER)                 9.73E+11   1.06E+13   4.12E+15   2.79E+16

  COMMENTS ON THE EFFLUENT CHARACTERISTICS---------

            COMPONENT
            NO.    NAME          REMARKS
            ---  ------------    ------------------------------------------------------------------

             1   PROBE + 10      ARMAMENT LAB DID ELEMENTAL ANALYSIS & ROCKWELL DID SULFATE, NI-
                                 TRATE & TOTAL CARBON. PROBE WT IS 228MG & CYCLONE WT IS 269 MG
```

EXHIBIT C.4-4 (Cont'd)

```
FPEIS TEST SERIES NO: 00233    STREAM NO: 01    TEST ID NO: 001    SAMPLE NO: 02                               PAGE        9
                                                                                              SERIES FORM 6    DATE 07/30/82

  SAMPLING ACTIVITY DESCRIPTION-------------------

        MEASUREMENT INSTRUMENT/METHOD TYPE: I  NAME: SASS TRAIN-WITH CYCLONES        SAMPLING START TIME: 1133  DURATION: 181 MIN

        SAMPLING CONDITIONS-- MASS/VOLUMETRIC FLOWRATE=     8.4 M3/SEC  FLOWRATE METHOD: PITOT TUBE           TEMPERATURE=  216 C

                              MOISTURE CONTENT= 7.5 PCT    VELOCITY=  17.0 M/SEC   PRESSURE= 100 MM HG

                              SAMPLE DENSITY= 1.0 G/CM3   DENSITY DETERMINATION: ASSUMED


        DEVICE SAMPLING LOCATION=OUTLET   DEVICE/PROCESS NUMBER=   1 SAMPLING LOCATION DESCRIPTION: 3.5 M FROM ESP OUTLET

        SYSTEM SAMPLING LOCATION= OUTLET                       CORRESPONDING SAMPLE NUMBER:

        VOLUME OF SAMPLE COLLECTED=  20.00 M3    TOTAL MASS OF SAMPLE COLLECTED=    1.66  G

        MEASUREMENT INSTRUMENT:  TEMPERATURE=  206 C   INLET PRESSURE= 101 MM HG FLOW RATE=  195.0  L/MIN

        ESTIMATED TIME BETWEEN SAMPLING AND CHEM ANALYSIS:      DAYS          -SAMPLING AND RADIOASSAY:      DAYS

        COLLECTION SURFACE/SUBSTRATE:

        PERCENT ISOKINETIC SAMPLING=  93    GAS ANALYSIS (PCT BY WEIGHT)-- CO2= 10.50   CO=         O2=  9.50   N2= 80.00

        OTHER TRACE GASES (IN PPM): NOX-500,SO2-20,NO2-60                                          DILUTION FACTOR=    1.0

        PARTICLE MEASUREMENTS WERE MADE ON THE BASIS OF MASS    UPPER BOUNDARY DIAMETER=   30.00 UM


        PARTICLE DIAMETERS ARE DEFINED ACCORDING TO THE FOLLOWING DEFINITION:  CLASSIC AERODYNAMIC

        PARTICLE DIAMETERS WERE DETERMINED FROM CALIBRATION




  COMMENTS ON THE SAMPLING ACTIVITY---------------

                              OF TOTAL MASS, 723 MG IS INORGANIC & 16.0 MG IS ORGANIC CAUGHT IN
                              IMPINGERS, GEDS 85.
```

EXHIBIT C.4-4 (Cont'd)

```
                                                                                                        PAGE        10
FPEIS TEST SERIES NO: 00233    STREAM NO: 01    TEST ID NO: 001    SAMPLE NO: 02      SERIES FORM 7    DATE 07/30/82

 EFFLUENT STREAM DESIGN CHARACTERISTICS-----------

      COMPONENT
      NO  NAME          DESCRIPTION                                          VALUE
      --  ------------  ---------------------------------------------------  -----------------------------------

       1  PROBE + 10
                        STAGE/FILTER CUT SIZE:                                  9.20     UM
                        STAGE WEIGHT:                                          4.43E+02 MG

       2  3 UM CYCLONE
                        STAGE/FILTER CUT SIZE:                                  3.80     UM
                        STAGE WEIGHT:                                          6.61E+01 MG

       3  1 UM CYCLONE
                        STAGE/FILTER CUT SIZE:                                  1.30     UM
                        STAGE WEIGHT:                                          1.61E+02 MG
                        COMPONENT (ALIQUOT) MASS/VOLUME:                       161.000  MG
                        CHEMICAL ANALYSIS LABORATORY NAME:                     ARNAME

       4  FILTER
                        STAGE/FILTER CUT SIZE:                                   .01     UM
                        STAGE WEIGHT:                                          2.51E+02 MG
                        COMPONENT (ALIQUOT) MASS/VOLUME:                       251.000  MG

 PARTICLE SIZE TABLE---------

   STAGE #                           1          2          3          4
                                 --------   --------   --------   --------
   D50(MICRONS)                      9.20       3.80       1.30        .01
   STAGE WEIGHTS(MILLIGRAMS)     4.43E+02   6.61E+01   1.61E+02   2.51E+02
   MICROGRAMS/DNCM/STAGE         2.27E+05   3.39E+04   8.26E+04   1.29E+05
   NUMBER/DNCM/STAGE             9.46E+10   3.13E+11   1.44E+13   3.16E+14
   CUM. %MASS<D50                   51.91      44.73      27.25
   CUM. MICROGRAMS/ACM<D50       1.35E+04   1.17E+04   7.11E+03   0.00E-0
   CUM. MICROGRAMS/DNCM<D50      2.45E+05   2.11E+05   1.29E+05   0.00E-0
   GEOM D50                      1.66E+01   5.91E+00   2.22E+00   9.19E-01
   DM/DLOGD-(MICRONS)            4.42E+05   8.83E+04   1.77E+05   6.09E+04
   DN/LOGD-(NUMBER)              1.84E+11   8.15E+11   3.08E+13   1.50E+14

   COMMENTS ON THE EFFLUENT CHARACTERISTICS---------

           COMPONENT
           NO.    NAME          REMARKS
           ---  ------------    ---------------------------------------------------------------

            1   PROBE + 10      PROBE WT IS 373 MG & 10 UM CYCLONE IS 70.3 MG.
```

EXHIBIT C.4-4 (Cont'd)

```
                                                                                       PAGE    11
TEST SERIES NO: 00233    STREAM NO: 01    TEST ID NO: 001    SAMPLE: 02    SERIES FORM 7    DATE 07/30/82

EFFLUENT CHARACTERISTICS SUMMARY----------------

COMMENTS ON THE EFFLUENT CHARACTERISTICS---------

        COMPONENT
        NO.   NAME          REMARKS
        ---  ------------   -----------------------------------------------------------------

         3   1 UM CYCLONE   ARMAMENT LAB DID ELEMENTAL ANALYSIS & ROCKWELL DID SULFATE, NI-
                            TRATE & TOTAL CARBON.

         3   1 UM CYCLONE   ARMAMENT LAB DID ELEMENTAL ANALYSIS & ROCKWELL DID SULFATE, NI-
                            TRATE & TOTAL CARBON.
```

EXHIBIT C.4-4 (Cont'd)

```
SS-R2                          FPEIS SNAP-SHOT INFORMATION SUMMARY                              PAGE      3
                               -----------------------------------              FORM 1    DATE 08/04/82

 TEST SERIES NO:   223  DESCRIBES SAMPLING AT SITE FROM 02/16/78 TO 02/16/78 BY KVB, INC.

                        SPONSOR ORGANIZATION:    CALIFORNIA AIR RESOURCES BOARD
                        CONTRACT NUMBER:         A6-191-30
                        TASK/DIRECTIVE NUMBER:   000

 SOURCE DESCRIPTION------------------------------

                    SOURCE CATEGORY:        CONSUMER PRODUCTS          SOURCE NAME:   CONFIDENTIAL
                    SOURCE TYPE:            GLASS                      SITE NAME:
                    PRODUCT/DEVICE:         BOTTLES                    ADDRESS:
                    PROCESS TYPE:           MANUFACTURE                               LOS ANGELES        , CA
                    DESIGN PROCESS RATE:      4900   KG/HR             NPDES NUMBER:
                    FEED MATERIAL CATEGORY:   INORG CHEM

 EADS WASTE STREAM DATA BASES--------------------

                    WASTE STREAM DATA FROM OTHER MEDIA WHICH WERE COLLECTED CONCURRENTLY WITH THIS TEST SERIES
                    ARE AS FOLLOWS(TEST SERIES NUMBER-TSN):

                        FPEIS TSN:          LEDS TSN:          GEDS TSN: 00075    SDDS TSN:

 REFERENCE REPORT--------------------------------

                    TITLE
                    AUTHOR
                    SPONSOR REPORT NUMBER     NTIS NUMBER          PUBLICATION DATE
                    -------------------------------------------------------------------
                    FINE PARTICLE EMISSIONS FROM STATIONARY AND MISCELLANEOUS SOURCES
                    IN THE SOUTH COAST AIR BASIN.
                    TABACK H.J.
                    KVB REPORT 5806-783       PB 293 923/AS        FEBRUARY 1979

 DATA QUALITY INFORMATION SUMMARY----------------

                    PURPOSE OF TEST: EAS      ORIGINAL TEST DATA AVAILABLE:            QA PLAN AVAILABLE:

                    ENCODER NAME:


                    ORIGIN OF DATA ENCODED:
```

ENVIRONMENTAL ASSESSMENT DATA SYSTEM

EXHIBIT C.4-5

```
                                                                                         PAGE      4
                                                                               FORM 2    DATE 08/04/82
TEST SERIES COMMENTS-----------------------------
                    PROGRAM OBJECTIVES TO INVENTORY TSP EMISSIONS,TO PREPARE A COM-
                    PREHENSIVE INVENTORY OF EMISSIONS(I.E. BY SIZE DISTRIBUTION AND
                    CHEMICAL COMPOSITION),AND TO DESCRIBE ALT. METHODS OF CONTROL.
                    THE FURNACE TESTED HAS AN ENDPORT WITH 42.8 SQUARE METERS OF
                    SURFACE AREA.

CONTROL/TREATMENT SYSTEMS-----------------------

      STREAM NO  DEVICE NO  GENERIC DEVICE/PROCESS TYPE  DEVICE TYPE                     SPECIFIC PROCESS
      ---------  ---------  ---------------------------  ------------------------------  ---------------------

          1          1      NONE

STREAM SUMMARY-----------------------------------

                  # OF    INORGANIC  NON-LEVEL 1   LEVEL 1  RADIONUCLIDES  BIOASSAY
       STREAM NO SAMPLES  CHEMICALS  ORGANIC DATA   DATA        DATA         DATA
       --------- -------  ---------  ------------  -------  -------------  --------
           1        1        YES          NO          NO          NO          NO
       ---------------------------
       TOTAL NUMBER OF STREAMS:  1
       TOTAL NUMBER OF SAMPLES:  1
```

EXHIBIT C.4-5 (Cont'd)

```
STORET RETRIEVAL DATE 82/06/22  -  INVENT - VERSION OF SEP. 1981
                                                         01466500
                                                        39 53 05.0 074 30 20.0  2
                                                        MCDONALDS B IN LEBANON STATE FOREST NJ
                                                        34005 NEW JERSEY            BURLINGTON
                                                                                    020691

/TYPA/AMBNT/STREAM                                      112WRD                        02040202000
                                                         0000  CLASS 00 CSN-RSP 0014708-0186194

INDEX 0208001  002880  00610  0480   0080   0120
MILES 0111.06 0008.61 019.80 003.40 006.40 003.72
PARAMETER                                  RMK   NUMBER     MEAN  VARIANCE STAN DEV COFF VAR STAND ER MAXIMUM   MINIMUM  BEG DATE END DATE
00008   LAB       IDENT.      NUMBER                  4   566248 .141E+12   375952  .663936   187976   760720   2361.00 74/06/21 75/09/11
00010  WATER       TEMP        CENT                 226  10.4570  27.5768  5.25136  .502188  .349316  27.4000  .600000 58/03/12 82/01/26
00020   AIR        TEMP        CENT                  95  15.8589  89.5514  9.46316  .596711  .970900  39.0000-.269E+01 59/03/26 75/02/20
00028  ANALYZE    AGENCY       CODE                  19  75800.1 .336E+09  18354.8  .242147  4210.88  80020.0  3.90000 78/09/20 82/03/09
00060  STREAM      FLOW        CFS                   51  4.48824  273.380  16.5342  3.68389  2.31525  120.000  1.10000 58/03/12 72/09/20
00061  STREAM      FLOW,    INST-CFS                241  2.62316  4.68281  2.16398  .824950  .139394  22.2000  .035000 59/02/20 81/09/24
                                          J           2  2.62000  5.64479  2.37588  .906824  1.68000  4.30000  .940000 77/12/15 81/01/21
                                          TOT       243  2.62314  4.66743  2.16042  .823603  .138591  22.2000  .035000 59/02/20 81/09/24
00065  STREAM     STAGE        FEET                   7  1.14143  .077581  .278534  .244022  .105276  1.35000  .530000 80/11/12 82/01/26
00070   TURB      JKSN         JTU                   17  1.94118  5.55881  2.35771  1.21458  .571829  9.99999  .000000 74/02/12 78/07/06
00080  COLOR      PT-CO       UNITS                  57  28.1929  629.090  25.0817  .889646  3.32215  110.000  2.00000 58/03/12 75/07/10
00095 CNDUCTVY    AT 25C     MICROMHO               118  51.1604  1069.76  32.7072  .639308  3.01094  327.000  24.0000 58/03/12 82/03/09
00300    DO                    MG/L                  88  4.60563  6.02781  2.45516  .533078  .261721  10.8000  1.20000 65/11/26 82/01/26
00310   BOD       5 DAY        MG/L                  80  .791244  .679038  .824038  1.04144  .092130  5.30000  .100000 69/03/20 82/01/26
00400    PH                     SU                  116  4.18581  .174389  .417599  .099765  .038773  6.00000  3.20000 58/03/12 82/03/09
00403   LAB        PH           SU                    7  5.07143  .519086  .720476  .142066  .272314  6.20000  4.30000 80/11/12 82/01/26
00405   CO2                    MG/L                  84  17.8690  12431.0  111.494  6.23953  12.1650  1010.00  .000000 58/03/12 79/09/13
00410  T ALK      CACO3        MG/L                  60  .300000  .518644  .720170  2.40057  .092973  4.00000  .000000 58/03/12 80/09/17
                                          K          37  1.00000  .000000  .000000           .000000  1.00000  1.00000 74/02/12 79/09/13
                                          TOT        97  .567010  .435567  .659975  1.16396  .067010  4.00000  .000000 58/03/12 80/09/17
00435 T ACDITY    CACO3        MG/L                  65  17.8061  1129.27  33.6046  1.88725  4.16814  273.000  .000000 65/11/26 82/01/26
00440 HCO3 ION     HCO3        MG/L                  83  .144578  .222745  .471958  3.26438  .051804  3.00000  .000000 58/03/12 78/05/09
00445 CO3 ION      CO3         MG/L                  68  .000000  .000000  .000000           .000000  .000000  .000000 58/03/12 77/01/26
00515 RESIDUE    DISS-105    C MG/L                  17  30.4705  108.393  10.4112  .341681  2.52508  59.0000  21.0000 67/10/20 77/11/29
00530 RESIDUE    TOT NFLT      MG/L                  15  1.66666  5.95239  2.43975  1.46385  .629941  9.00000  .000000 70/09/28 78/07/06
                                          K          16  .999999 .572E-06  .000756  .000756  .000189  1.00000  .999999 67/10/20 77/11/29
                                          TOT        31  1.32258  2.89247  1.70073  1.28592  .305460  9.00000  .000000 67/10/20 78/07/06
00600 TOTAL N        N         MG/L                  30  .297000  .107236  .327468  1.10259  .059787  1.70000  .060000 73/11/28 82/03/09
00602   DISS.    NITROGEN     MG/L N                  5  .202000  .007670  .087579  .433560  .039167  .300000  .070000 80/11/12 82/03/09
00605  ORG N         N         MG/L                  31  .241290  .104372  .323066  1.33891  .058024  1.70000  .000000 73/02/13 82/03/09
00607  ORG N      DISS-N       MG/L                   4  .140000  .008467  .092015  .657247  .046007  .260000  .050000 80/11/12 81/07/15
00608 NH3+NH4-    N DISS       MG/L                   5  .012000  .000070  .008367  .697217  .003742  .020000  .000000 80/11/12 81/11/12
                                          K           3  .010000  .000000  .000000           .000000  .010000  .010000 81/03/18 82/03/09
                                          TOT         8  .011250  .000041  .006409  .569663  .002266  .020000  .000000 80/11/12 82/03/09
00610 NH3+NH4-   N TOTAL       MG/L                  27  .034074  .001187  .034447  1.01095  .006629  .130000  .000000 73/02/13 82/03/09
                                          K           6  .010000-.931E-10  .000000           .000000  .010000  .010000 74/12/26 78/05/09
                                          TOT        33  .029697  .001053  .032450  1.09272  .005649  .130000  .000000 73/02/13 82/03/09
00615  NO2-N      TOTAL        MG/L                   6  .008500  .000014  .003674  .432263  .001500  .010000  .001000 73/11/28 75/06/04
                                          K           8  .010000 .665E-10  .000008  .000816  .000003  .010000  .010000 74/02/12 75/07/10
                                          TOT        14  .009357  .000006  .002405  .257063  .000643  .010000  .001000 73/11/28 75/07/10
00618  NO3-N       DISS        MG/L                  50  .071600  .009842  .099208  1.38560  .014030  .450000  .000000 58/03/12 72/09/20
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NATIONAL HYDROLOGIC BENCHMARK NETWORK

EXHIBIT C.4-6

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STORET RETRIEVAL DATE 82/06/22  -  INVENT - VERSION OF SEP. 1981
                                                          01466500
                                                          39 53 05.0 074 30 20.0  2
                                                          MCDONALDS B IN LEBANON STATE FOREST NJ
                                                          34005 NEW JERSEY         BURLINGTON
                                                                                   020691

                                                          112WRD                      02040202000
/TYPA/AMBNT/STREAM                                         0000  CLASS 00 CSN-RSP 001470A-0186194

INDEX 0208001  002880  00610  0480   0080   0120
MILES 0111.06 0008.61 019.80 003.40 006.40 003.72   *      *        *         *         *
PARAMETER                              RMK   NUMBER     MEAN   VARIANCE  STAN DEV  COFF VAR  STAND ER  MAXIMUM   MINIMUM  BEG DATE END DATE
00620  NO3-N      TOTAL      MG/L               15   .010000   .000243   .015584   1.55839   .004024   .060000   .000000 73/02/13 75/07/10
00623 KJELDL N     DISS      MG/L                6   .136667   .005987   .077374   .566148   .031588   .270000   .050000 80/11/12 82/03/09
                                        K        2   .100000   .000000   .000000             .000000   .100000   .100000 81/03/18 81/11/12
                                        TOT      8   .127500   .004564   .067559   .529878   .023886   .270000   .050000 80/11/12 82/03/09
00624 KJELDL N     SUSP      MG/L                5   .194000   .017130   .130882   .674648   .058532   .400000   .050000 80/11/12 82/03/09
00625 TOT KJEL      N        MG/L               31   .269355   .099846   .315985   1.17312   .056753   1.70000   .010000 73/02/13 82/03/09
                                        K        2   .100000   .000000   .000000             .000000   .100000   .100000 81/03/18 81/11/12
                                        TOT     33   .259091   .095290   .308691   1.19144   .053736   1.70000   .010000 73/02/13 82/03/09
00630 NO2&NO3    N-TOTAL     MG/L               43   .030698   .001559   .039484   1.28624   .006021   .220000   .010000 73/11/28 82/03/09
                                        K       13   .093077   .000623   .024962   .268187   .006923   .100000   .010000 74/02/12 81/05/19
                                        TOT     56   .045179   .002033   .045085   .997940   .006025   .220000   .010000 73/11/28 82/03/09
00631 NO2&NO3     N-DISS     MG/L               14   .037143   .001407   .037505   1.00974   .010024   .140000   .010000 79/11/28 82/03/09
00650  T PO4       PO4       MG/L               12   .125000   .116810   .341774   2.73419   .098662   1.20000   .000000 64/01/22 79/05/09
00660 ORTHOPO4     PO4       MG/L               40   .018500   .001408   .037523   2.02825   .005933   .180000   .000000 65/02/05 80/09/17
00665 PHOS-TOT               MG/L P             38   .011579   .000039   .006267   .541254   .001017   .030000   .000000 71/10/29 82/03/09
                                        K       23   .010000  .634E-10   .000008   .000797   .000002   .010000   .010000 74/02/12 81/07/15
                                        TOT     61   .010984   .000025   .004982   .453548   .000638   .030000   .000000 71/10/29 82/03/09
00666 PHOS-DIS               MG/L P              3   .010000   .000100   .010000   1.00000   .005774   .020000   .000000 80/11/12 81/11/12
                                        K        5   .010000-.582E-10   .000000             .000000   .010000   .010000 81/03/18 82/03/09
                                        TOT      8   .010000   .000029   .005345   .534523   .001890   .020000   .000000 80/11/12 82/03/09
00671 PHOS-DIS    ORTHO      MG/L P             12   .006583   .000134   .011556   1.75532   .003336   .040000   .000000 71/10/29 80/09/17
                                        K        2   .010000-.145E-10   .000000             .000000   .010000   .010000 73/11/28 74/02/12
                                        TOT     14   .007071   .000115   .010702   1.51342   .002860   .040000   .000000 71/10/29 80/09/17
00680 T ORG C       C        MG/L               51   7.37055   15.6627   3.95761   .536949   .554176   18.0000   .700000 71/03/31 82/01/26
00681 D ORG C       C        MG/L                4   4.20000   7.84668   2.80119   .666950   1.40060   6.60000   1.00000 80/11/12 82/03/09
00689 S ORG C       C        MG/L                4   .100000   .006667   .081650   .816496   .040825   .200000   .000000 80/11/12 82/03/09
00720 CYANIDE     CN-TOT     MG/L               15   .000000   .000000   .000000             .000000   .000000   .000000 74/02/12 80/11/12
                                        K        1   .010000                                           .010000   .010000 81/05/19 81/05/19
                                        TOT     16   .000625   .000006   .002500   4.00000   .000625   .010000   .000000 74/02/12 81/05/19
00746 SULFIDE    DISOLVED    MG/L                4   .000000   .000000   .000000             .000000   .000000   .000000 76/11/17 78/05/09
00900 TOT HARD    CACO3      MG/L              106   4.70754   7.23747   2.69025   .571478   .261301   17.0000   1.00000 58/03/12 82/01/26
00902 NC HARD     CACO3      MG/L               95   4.54736   8.03763   2.83507   .623454   .290872   17.0000   .000000 58/03/12 80/09/17
00915 CALCIUM    CA,DISS     MG/L              105   1.04942   .436194   .660450   .629345   .064453   3.40000   .000000 58/03/12 82/01/26
00916 CALCIUM     CA-TOT     MG/L                1   .599999                                           .599999   .599999 73/02/13 73/02/13
00925 MGNSIUM    MG,DISS     MG/L              105   .509709   .128555   .358545   .703431   .034990   2.40000   .000000 58/03/12 82/01/26
00927 MGNSIUM    MG,TOT      MG/L                1   .500000                                           .500000   .500000 73/02/13 73/02/13
00929 SODIUM     NA,TOT      MG/L                1   1.60000                                           1.60000   1.60000 73/02/13 73/02/13
00930  SODIUM    NA,DISS     MG/L              102   1.87744   .235617   .485404   .258545   .048062   3.40000   1.10000 58/03/12 82/01/26
00931  SODIUM    ADSRATION   RATIO             105   .425710   .034237   .185033   .434646   .018057   1.90000   .200000 58/03/12 82/01/26
00932  PERCENT    SODIUM     %                 104   46.9902   144.293   12.0122   .255632   1.17789   84.0000   16.0000 58/03/12 82/01/26
00933   NA+K                 MG/L                6   2.96667   5.30666   2.30362   .776501   .940449   7.60000   1.40000 65/11/26 80/03/28
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EXHIBIT C.4-6 (Cont'd)

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STORET RETRIEVAL DATE 82/06/22  -  INVENT - VERSION OF SEP. 1981
                                                                  01466500
                                                                  39 53 05.0 074 30 20.0  2
                                                                  MCDONALDS B IN LEBANON STATE FOREST NJ
                                                                  34005 NEW JERSEY          BURLINGTON
                                                                                            020691

/TYPA/AMBNT/STREAM                                                112WRD                    02040202000
                                                                   0000  CLASS 00 CSN-RSP 0014708-0186194

INDEX 0208001  002880  00610  0480   0080   0120
MILES 0111.06 0008.61 019.80 003.40 006.40 003.72   .        .         .        .        .
PARAMETER                                RMK   NUMBER    MEAN   VARIANCE STAN DEV COFF VAR STAND ER MAXIMUM   MINIMUM  BEG DATE END DATE
00935 PTSSIUM      K,DISS       MG/L              100  .424995  .486944  .697813  1.64193  .069781  6.40000  .000000 58/03/12 82/01/26
                                         J          1  .000000                                      .000000  .000000 63/07/13 63/07/13
                                         K          1  .100000                                      .100000  .100000 74/12/26 74/12/26
                                         TOT      102  .417642  .480081  .692879  1.65902  .068605  6.40000  .000000 58/03/12 82/01/26
00937 PTSSIUM      K,TOT        MG/L                1  .100000                                      .100000  .100000 73/02/13 73/02/13
00940 CHLORIDE       TOTAL      MG/L              106  3.69996  1.28366  1.13298  .306215  .110045  9.50000  2.00000 58/03/12 82/01/26
00945 SULFATE      SO4-TOT      MG/L              106  6.61502  15.4321  3.92838  .593857  .381558  19.0000  .300000 58/03/12 82/01/26
00950 FLUORIDE      F,DISS      MG/L               75  .145333  .046566  .215791  1.48480  .024917  1.60000  .000000 58/03/12 81/05/19
                                         K         23  .100000 .650E-07  .000255  .002550  .000053  .100000  .100000 74/04/19 82/01/26
                                         TOT       98  .134694  .035897  .189466  1.40664  .019139  1.60000  .000000 58/03/12 82/01/26
00951 FLUORIDE      F,TOTAL     MG/L                1  .200000                                      .200000  .200000 73/02/13 73/02/13
00955  SILICA      DISOLVED     MG/L               99  3.43229  1.27722  1.13014  .329268  .113584  6.69999  .000000 58/03/12 82/01/26
01000 ARSENIC      AS,DISS      UG/L                5  .400000  .300000  .547722  1.36931  .244949  1.00000  .000000 70/10/12 81/05/19
01001 ARSENIC      AS,SUSP      UG/L                4  .000000  .000000  .000000           .000000  .000000  .000000 79/11/28 81/05/19
01002 ARSENIC      AS,TOT       UG/L                9  1.22222  1.44445  1.20185  .983333  .400617  4.00000  .000000 74/06/21 81/05/19
                                         K          7 1.000000 .476E-06  .000691  .000691  .000261  1.00000  .999999 74/02/12 78/11/08
                                         TOT       16  1.12500  .783335  .885062  .786723  .221266  4.00000  .000000 74/02/12 81/05/19
01005  BARIUM      BA,DISS      UG/L                7  30.1428  918.473  30.3063  1.00542  11.4547  94.9999  10.0000 68/10/25 81/05/19
01006 BARIUM       BA,SUSP      UG/L                2  70.0000  200.000  14.1421  .202030  10.0000  80.0000  60.0000 80/11/12 81/05/19
01007 BARIUM       BA,TOT       UG/L                3  73.3333  2133.33  46.1880  .629837  26.6667  100.000  20.0000 79/11/28 81/05/19
                                         J          1  .000000                                      .000000  .000000 74/02/12 74/02/12
                                         K         12  95.8333  208.341  14.4340  .150616  4.16674  100.000  50.0000 74/06/21 80/05/28
                                         TOT       16  85.6250  1039.58  32.2426  .376556  8.06064  100.000  .000000 74/02/12 81/05/19
01010 BERYLIUM     BE,DISS      UG/L                1  .060000                                      .060000  .060000 74/09/12 74/09/12
                                         K          6  .725000  .139750  .373832  .515630  .152616  1.00000  .050000 68/10/25 81/05/19
                                         TOT        7  .630000  .179633  .423832  .672749  .160193  1.00000  .050000 68/10/25 81/05/19
01015 BISMUTH      BI,DISS      UG/L                1  .000000                                      .000000  .000000 74/09/12 74/09/12
                                         K          2  1.65000  3.64499  1.90919  1.15708  1.35000  3.00000  .300000 68/10/25 69/09/29
                                         TOT        3  1.10000  2.72999  1.65227  1.50206  .953938  3.00000  .000000 68/10/25 74/09/12
01020  BORON        B,DISS      UG/L                5  78.5999  8841.78  94.0307  1.19632  42.0518  240.000  8.99999 68/10/25 78/05/09
                                         K          2  20.0000  .000000  .000000           .000000  20.0000  20.0000 76/11/17 77/05/23
                                         TOT        7  61.8571  6712.12  81.9276  1.32446  30.9657  240.000  8.99999 68/10/25 78/05/09
01025 CADMIUM       CD,DISS     UG/L                4  1.25000  .916669  .957429  .765943  .478714  2.00000  .000000 70/10/12 80/11/12
                                         K          6  5.83332  108.166  10.4003  1.78291  4.24590  27.0000 1.000000 68/10/25 81/05/19
                                         TOT       10  3.99999  65.9997  8.12402  2.03101  2.56904  27.0000  .000000 68/10/25 81/05/19
01026 CADMIUM      CD,SUSP      UG/L                2  .000000  .000000  .000000           .000000  .000000  .000000 80/05/28 80/11/12
01027 CADMIUM      CD,TOT       UG/L                3  1.00000  1.00000  1.00000  1.00000  .577350  2.00000  .000000 80/05/28 81/05/19
                                         K          2  1.50000  .500000  .707107  .471404  .500000  2.00000  1.00000 76/03/23 79/11/28
                                         U         11  .000000  .000000  .000000           .000000  .000000  .000000 74/02/12 79/05/09
                                         TOT       16  .375000  .516667  .718795  1.91679  .179699  2.00000  .000000 74/02/12 81/05/19
01030 CHROMIUM     CR,DISS      UG/L                7  .928571  2.36904  1.53917  1.65757  .581751  4.00000  .000000 69/09/29 81/05/19
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EXHIBIT C.4-6 (Cont'd)

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STORET RETRIEVAL DATE 82/06/22  -  INVENT - VERSION OF SEP. 1981
                                                              01466500
                                                              39 53 05.0 074 30 20.0  2
                                                              MCDONALDS B IN LEBANON STATE FOREST NJ
                                                              34005 NEW JERSEY          BURLINGTON
                                                                                        020691

/TYPA/AMBNT/STREAM                                            112WRD                    02040202000
                                                               0000  CLASS 00 CSN-RSP 0014708-0186194

INDEX 0208001  002880  00610  0480   0080   0120
MILES 0111.06 0008.61 019.80 003.40 006.40 003.72   *       *        *        *        *        *
PARAMETER                                   RMK  NUMBER    MEAN   VARIANCE STAN DEV COFF VAR STAND ER MAXIMUM  MINIMUM  BEG DATE END DATE
01030 CHROMIUM   CR,DISS      UG/L          K        1  4.00000                                      4.00000  4.00000 68/10/25 68/10/25
                                            TOT      8  1.31250  3.20981  1.79159  1.36503  .633424  4.00000  .000000 68/10/25 81/05/19
01031 CHROMIUM   CR,SUSP      UG/L                   3  10.0000  .000000  .000000           .000000  10.0000  10.0000 79/11/28 81/05/19
01032 CHROMIUM   HEX-VAL      UG/L                   5  .000000  .000000  .000000           .000000  .000000  .000000 70/10/12 70/05/09
01034 CHROMIUM   CR,TOT       UG/L                   4  17.5000  225.000  15.0000  .857143  7.50000  40.0000  10.0000 76/11/17 81/05/19
                                            K       11  19.0909  9.09145  3.01520  .157939  .909118  20.0000  10.0000 74/02/12 80/05/28
                                            U        1  .000000                                      .000000  .000000 74/10/18 74/10/18
                                            TOT     16  17.5000  73.3333  8.56349  .489342  2.14087  40.0000  .000000 74/02/12 81/05/19
01035 COBALT     CO,DISS      UG/L                   7  1.78571  3.98809  1.99702  1.11833  .754803  5.00000  .000000 68/10/25 79/11/28
                                            K        3  3.00000  .000000  .000000           .000000  3.00000  3.00000 80/05/28 81/05/19
                                            TOT     10  2.15000  3.00278  1.73285  .805979  .547977  5.00000  .000000 68/10/25 81/05/19
01037  COBALT    CO,TOTAL     UG/L          K        1  2.00000                                      2.00000  2.00000 77/11/29 77/11/29
                                            U        3  .000000  .000000  .000000           .000000  .000000  .000000 76/11/17 78/05/09
                                            TOT      4  .500000  1.00000  1.00000  2.00000  .500000  2.00000  .000000 76/11/17 78/05/09
01040 COPPER     CU,DISS      UG/L                   4  29.7499  2862.90  53.5061  1.79853  26.7530  110.000  2.00000 68/10/25 79/11/28
                                            K        4  8.00000  16.0000  4.00000  .500000  2.00000  10.0000  2.00000 74/09/12 81/05/19
                                            TOT      8  18.8750  1368.98  36.9997  1.96025  13.0814  110.000  2.00000 68/10/25 81/05/19
01042 COPPER     CU,TOT       UG/L                   8  3.50000  3.71428  1.92725  .550642  .681385  8.00000  2.00000 77/11/29 81/05/19
                                            K        3  14.0000  108.000  10.3923  .742307  6.00000  20.0000  2.00000 74/02/12 76/11/17
                                            U        5  .000000  .000000  .000000           .000000  .000000  .000000 74/06/21 77/05/23
                                            TOT     16  4.37500  41.4500  6.43817  1.47158  1.60954  20.0000  .000000 74/02/12 81/05/19
01044    IRON    FE,SUSP      UG/L                   3  43.3333  233.336  15.2753  .352508  8.81922  60.0000  30.0000 80/05/28 81/05/19
01045    IRON    FE,TOT       UG/L                  17  323.529   224500  473.814  1.46452  114.917  2100.00  99.9998 73/02/13 81/05/19
01046    IRON    FE,DISS      UG/L                  50  319.178   212838  461.343  1.44541  65.2438  3099.99  70.0000 58/03/12 81/05/19
01049    LEAD    PB,DISS      UG/L                   6  8.16665  27.7666  5.26941  .645234  2.15123  16.0000 1.000000 68/10/25 74/09/12
                                            K        4 10.00000  .000081  .009021  .000902  .004511  10.0000 10.00000 79/11/28 81/05/19
                                            TOT     10  8.89999  16.3222  4.04008  .453942  1.27758  16.0000 1.000000 68/10/25 81/05/19
01051 LEAD       PB,TOT       UG/L                  13  4.15384  14.4744  3.80452  .915903  1.05518  13.0000  .000000 74/02/12 81/05/19
                                            U        1  .000000                                      .000000  .000000 74/06/21 74/06/21
                                            TOT     14  3.85714  14.5934  3.82013  .990405  1.02097  13.0000  .000000 74/02/12 81/05/19
01054 MANGNESE   MN,SUSP      UG/L                   3  .333333  .333333  .577350  1.73205  .333333  1.00000  .000000 80/05/28 81/05/19
01055 MANGNESE      MN        UG/L                  17  54.7059  12926.5  113.695  2.07829  27.5750  490.000  .000000 67/10/20 81/05/19
                                            K        8  10.0000  .000000  .000000           .000000  10.0000  10.0000 73/02/13 79/05/09
                                            TOT     25  40.4000  9070.67  95.2401  2.35743  19.0488  490.000  .000000 67/10/20 81/05/19
01056 MANGNESE   MN,DISS      UG/L                  44  42.6817  13053.7  114.253  2.67686  17.2243  769.999  .000000 58/03/12 81/05/19
01060   MOLY     MO,DISS      UG/L          K        7  5.95000  25.5908  5.05874  .850208  1.91202  10.0000  .050000 68/10/25 81/05/19
01065  NICKEL    NI,DISS      UG/L                   5  5.79998  72.6996  8.52641  1.47007  3.81313  21.0000 1.000000 68/10/25 74/09/12
01067  NICKEL    NI,TOTAL     UG/L                   2  2.50000  .500000  .707107  .282843  .500000  3.00000  2.00000 77/05/23 77/11/29
                                            K        1  2.00000                                      2.00000  2.00000 76/11/17 76/11/17
                                            U        1  .000000                                      .000000  .000000 78/05/09 78/05/09
                                            TOT      4  1.75000  1.58333  1.25831  .719032  .629153  3.00000  .000000 76/11/17 78/05/09
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EXHIBIT C.4-6 (Cont'd)

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STORET RETRIEVAL DATE 82/06/22  -  INVENT - VERSION OF SEP. 1981
                                                                    01466500
                                                                   39 53 05.0 074 30 20.0  2
                                                                   MCDONALDS B IN LEBANON STATE FOREST NJ
                                                                   34005 NEW JERSEY          BURLINGTON
                                                                                             020691

/TYPA/AMBNT/STREAM                                                 112WRD                      02040202000
                                                                    0000  CLASS 00 CSN-RSP 0014708-0186194

INDEX 0208001  002880  00610  0480   0080   0120
MILES 0111.06 0008.61 019.80 003.40 006.40 003.72      .        .        .        .        .        .
PARAMETER                                    RMK  NUMBER     MEAN VARIANCE STAN DEV COFF VAR STAND ER  MAXIMUM  MINIMUM BEG DATE END DATE
01075 SILVER     AG,DISS      UG/L                       4  .000000  .000000  .000000            .000000  .000000  .000000 79/11/28 81/05/19
                                             K           2  .165000  .036450  .190918  1.15708  .135000  .300000  .030000 68/10/25 69/09/29
                                             U           1  .000000                                      .000000  .000000 74/09/12 74/09/12
                                             TOT         7  .047143  .012557  .112058  2.37700  .042354  .300000  .000000 68/10/25 81/05/19
01076 SILVER     AG,SUSP      UG/L                       4  .000000  .000000  .000000            .000000  .000000  .000000 79/11/28 81/05/19
01077 SILVER     AG,TOT       UG/L                       4  .000000  .000000  .000000            .000000  .000000  .000000 79/11/28 81/05/19
                                             K           1  2.00000                                      2.00000  2.00000 74/08/27 74/08/27
                                             U          11  .000000  .000000  .000000            .000000  .000000  .000000 74/02/12 79/05/09
                                             TOT        16  .125000  .250000  .500000  4.00000  .125000  2.00000  .000000 74/02/12 81/05/19
01080 STRONTIUM  SR,DISS      UG/L                       7  11.7143  131.238  11.4559  .977944  4.32993  35.0000  4.00000 68/10/25 81/05/19
01085 VANADIUM    V,DISS      UG/L                       3  2.26666  10.4933  3.23933  1.42912  1.87023  5.99999  .200000 68/10/25 74/09/12
                                             K           4  6.00000  .000000  .000000            .000000  6.00000  6.00000 79/11/28 81/05/19
                                             TOT         7  4.40000  7.48001  2.73496  .621582  1.03372  6.00000  .200000 68/10/25 81/05/19
01090   ZINC     ZN,DISS      UG/L                       7  18.5714  165.620  12.8693  .692964  4.86415  39.0000  6.00000 68/10/25 81/05/19
                                             K           2  51.9999  4607.98  67.8821  1.30543  47.9999  99.9998  4.00000 69/09/29 80/05/28
                                             TOT         9  26.0000  917.497  30.2902  1.16501  10.0967  99.9998  4.00000 68/10/25 81/05/19
01091 ZINC       ZN,SUSP      UG/L                       2  5.00000  50.0000  7.07107  1.41421  5.00000  10.0000  .000000 80/11/12 81/05/19
01092 ZINC       ZN,TOT       UG/L                      14  32.8571  345.056  18.5757  .565347  4.96456  80.0000  20.0000 74/06/21 81/05/19
                                             K           1  20.0000                                      20.0000  20.0000 75/09/11 75/09/11
                                             U           1  .000000                                      .000000  .000000 74/02/12 74/02/12
                                             TOT        16  30.0000  373.333  19.3218  .644061  4.83046  80.0000  .000000 74/02/12 81/05/19
01100   TIN      SN,DISS      UG/L                       1  .000000                                      .000000  .000000 74/09/12 74/09/12
                                             K           2  .400000  .020000  .141421  .353554  .100000  .500000  .300000 68/10/25 69/09/29
                                             TOT         3  .266666  .063333  .251661  .943729  .145296  .500000  .000000 68/10/25 74/09/12
01105 ALUMINUM    AL,TOT      UG/L                       4  175.000  9233.31  96.0901  .549087  48.0451  300.000  90.0000 63/06/19 78/05/09
01106 ALUMINUM    AL,DISS     UG/L                      26  329.998  75800.5  275.319  .834304  53.9945  1400.00  .000000 65/02/05 78/05/09
                                             K           1  100.000                                      100.000  100.000 77/05/23 77/05/23
                                             TOT        27  321.480  74844.1  273.577  .850991  52.6498  1400.00  .000000 65/02/05 78/05/09
01120 GALLIUM    GA,DISS      UG/L                       1  .000000                                      .000000  .000000 74/09/12 74/09/12
                                             U           1  .000000                                      .000000  .000000 69/09/29 69/09/29
                                             TOT         2  .000000  .000000  .000000            .000000  .000000  .000000 69/09/29 74/09/12
01125 GERMANUM   GE,DISS      UG/L                       1  .000000                                      .000000  .000000 74/09/12 74/09/12
                                             K           2  4.00000  1.99998  1.41421  .353552  .999997  5.00000  3.00000 68/10/25 69/09/29
                                             TOT         3  2.66666  6.33332  2.51661  .943730  1.45296  5.00000  .000000 68/10/25 74/09/12
01130 LITHIUM    LI,DISS      UG/L                       1  .800000                                      .800000  .800000 74/09/12 74/09/12
                                             K           4  4.00000  .000000  .000000            .000000  4.00000  4.00000 79/11/28 81/05/19
                                             TOT         5  3.36000  2.04804  1.43110  .425922  .640006  4.00000  .800000 74/09/12 81/05/19
01145 SELENIUM   SE,DISS      UG/L                       4  .000000  .000000  .000000            .000000  .000000  .000000 79/11/28 81/05/19
01146 SELENIUM   SE,SUSP      UG/L                       4  .000000  .000000  .000000            .000000  .000000  .000000 79/11/28 81/05/19
01147 SELENIUM   SE,TOT       UG/L                       6  .333333  .266666  .516397  1.54919  .210818  1.00000  .000000 74/02/12 81/05/19
                                             K          10  1.00000  .000000  .000000            .000000  1.00000  1.00000 74/08/27 79/05/09
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EXHIBIT C.4-6 (Cont'd)

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STORET RETRIEVAL DATE 82/06/22  -  INVENT - VERSION OF SEP. 1981
                                                    01466500
                                                   39 53 05.0 074 30 20.0  2
                                                   MCDONALDS B IN LEBANON STATE FOREST NJ
                                                   34005 NEW JERSEY         BURLINGTON
                                                                            020691

/TYPA/AMBNT/STREAM                                 112WRD                  02040202000
                                                    0000  CLASS 00 CSN-RSP 0014708-0186194

INDEX 0208001  002880  00610  0480   0080   0120
MILES 0111.06 0008.61 019.80 003.40 006.40 003.72
PARAMETER                                 RMK   NUMBER      MEAN  VARIANCE  STAN DEV  COFF VAR  STAND ER   MAXIMUM   MINIMUM BEG DATE END DATE
01147 SELENIUM     SE,TOT        UG/L     TOT       16   .750000   .200000   .447214   .596285   .111803   1.00000   .000000 74/02/12 81/05/19
01150 TITANIUM     TI,DISS       UG/L                3   2.43333   9.66331   3.10859   1.27750   1.79474   5.99999   .300000 68/10/25 74/09/12
01160 ZIRCONUM     ZR,DISS       UG/L                1   .000000                                           .000000   .000000 74/09/12 74/09/12
                                          U          1   .000000                                           .000000   .000000 69/09/29 69/09/29
                                          TOT        2   .000000   .000000   .000000             .000000   .000000   .000000 69/09/29 74/09/12
01515 ALPHA-D      AS U-NAT      PC/L               10   .739999   .151556   .389302   .526084   .123108   1.40000   .300000 67/10/20 80/11/12
01516 ALPHA-S      AS U-NAT      PC/L                1   .400000                                           .400000   .400000 69/09/29 69/09/29
                                          K          9   .144444   .007778   .088192   .610560   .029397   .300000   .100000 67/10/20 80/11/12
                                          TOT       10   .170000   .013445   .115950   .682062   .036667   .400000   .100000 67/10/20 80/11/12
03515  BETA-D      AS CS137      PC/L               20   3.55499   4.87103   2.20704   .620828   .493509   7.60000   .700000 67/10/20 80/11/12
03516  BETA-S      AS CS137      PC/L                3   .633333   .003335   .057745   .091177   .033339   .700000   .599999 67/10/20 70/09/28
                                          K         17   .417647   .002794   .052861   .126570   .012821   .600000   .400000 68/12/13 80/11/12
                                          TOT       20   .450000   .008948   .094592   .210204   .021151   .700000   .400000 67/10/20 80/11/12
09511 RA-226-D     RADON MT      PC/L               20   .198500   .007624   .087316   .439880   .019524   .420000   .100000 67/10/20 80/11/12
31501 TOT COLI     MFIMENDO      /100ML             58   215.273    636408   797.752   3.70577   104.750   6000.00   .000000 68/04/30 80/09/17
                                          B         12   200.416    360376   600.313   2.99533   173.295   2100.00   .999999 75/10/29 80/07/22
                                          K          3   1.33333   .333334   .577351   .433014   .333334   2.00000   .999999 76/01/15 78/03/21
                                          TOT       73   204.039    560696   748.796   3.66988   87.6400   6000.00   .000000 68/04/30 80/09/17
31615 FEC COLI     MPNECMED      /100ML              3   8.99998   147.000   12.1243   1.34715   6.99999   23.0000   2.00000 75/04/17 75/06/04
                                          K          1   2.00000                                           2.00000   2.00000 75/03/14 75/03/14
                                          TOT        4   7.24998   110.250   10.5000   1.44828   5.24999   23.0000   2.00000 75/03/14 75/06/04
31616 FEC COLI     MFM-FCBR      /100ML             26   26.4614   3308.95   57.5235   2.17387   11.2813   260.000   .000000 70/07/30 76/07/15
                                          B          2   6.49999   60.4998   7.77816   1.19664   5.49999   12.0000   .999999 76/05/27 76/09/14
                                          K          6   1.33333   .266667   .516398   .387299   .210819   2.00000   .999999 75/03/14 76/03/23
                                          TOT       34   20.8528   2615.20   51.1390   2.45238   8.77027   260.000   .000000 70/07/30 76/09/14
31625 FEC COLI     M-FCAGAD      /100 ML             2   13.5000   4.50024   2.12138   .157139   1.50006   15.0000   12.0000 77/09/20 78/07/06
                                          B         16   2.81250   5.89583   2.42813   .863337   .607033   8.00000   .999999 77/07/25 82/01/26
                                          K         11   1.09091   .290910   .539361   .494415   .162623   2.00000   .000000 77/01/26 81/05/19
                                          TOT       29   2.89655   12.7389   3.56916   1.23221   .662775   15.0000   .000000 77/01/26 82/01/26
31673 FECSTREP     MFKFAGAR      /100ML             20   101.100   12762.5   112.971   1.11742   25.2611   440.000   6.99999 76/11/17 82/01/26
                                          B          7   37.9999   5176.99   71.9513   1.89346   27.1950   200.000   2.00000 77/01/26 80/01/24
                                          J          1   1.10000                                           1.10000   1.10000 81/05/19 81/05/19
                                          TOT       28   81.7534   11146.0   105.574   1.29138   19.9517   440.000   1.10000 76/11/17 82/01/26
31679 FECSTREP     MF M-ENT      /100ML             24   31.8332   3187.16   56.4549   1.77346   11.5238   252.000   .000000 71/10/29 76/05/27
                                          B          1   20.0000                                           20.0000   20.0000 76/07/15 76/07/15
                                          K          6   1.16666   .166669   .408251   .349930   .166668   2.00000   .999999 75/03/14 76/09/14
                                          TOT       31   25.5160   2595.03   50.9414   1.99645   9.14935   252.000   .000000 71/10/29 76/09/14
38260   MBAS                     MG/L                6   .013334   .000027   .005164   .387293   .002108   .020000   .010000 66/03/05 70/04/29
39034 PERTHANE     WHL SMPL      UG/L                2   .000000   .000000   .000000             .000000   .000000   .000000 78/11/08 79/11/28
                                          K          1   .010000                                           .010000   .010000 80/11/12 80/11/12
                                          TOT        3   .003333   .000033   .005774   1.73205   .003333   .010000   .000000 78/11/08 80/11/12
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EXHIBIT C.4-6 (Cont'd)

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STORET RETRIEVAL DATE 82/06/22  -  INVENT - VERSION OF SEP. 1981
                                                                     01466500
                                                                     39 53 05.0 074 30 20.0  2
                                                                     MCDONALDS B IN LEBANON STATE FOREST NJ
                                                                     34005 NEW JERSEY         BURLINGTON
                                                                                              020691

/TYPA/AMBNT/STREAM                                                   112WRD                       02040202000
                                                                      0000  CLASS 00 CSN-RSP 001470B-0186194

INDEX 0208001  002880  00610  0480   0080   0120
MILES 0111.06 0008.61 019.80 003.40 006.40 003.72
PARAMETER                                    RMK   NUMBER    MEAN   VARIANCE STAN DEV COFF VAR STAND ER MAXIMUM   MINIMUM  BEG DATE END DATE
39250  NAPTHAL   ENES, PC   . UG/L                    4  .000000  .000000  .000000           .000000  .000000  .000000 76/11/17 79/11/28
                                             K        1  .100000                                      .100000  .100000 80/11/12 80/11/12
                                             TOT      5  .020000  .002000  .044721 2.23607  .020000  .100000  .000000 76/11/17 80/11/12
39251   PCNS       MUD        UG/KG          K        2 1.00000   .000000  .000000           .000000 1.00000  1.00000  80/11/12 81/11/12
39330 ALDRIN                TOT UG/L                 14  .000000  .000000  .000000           .000000  .000000  .000000 67/10/20 79/11/28
                                             K        1  .010000                                      .010000  .010000 80/11/12 80/11/12
                                             TOT     15  .000667  .000007  .002582 3.87298  .000667  .010000  .000000 67/10/20 80/11/12
39333 ALDRIN     SEDUG/KG    DRY WGT                 11  .000000  .000000  .000000           .000000  .000000  .000000 67/10/20 79/11/28
                                             K        5  .160000  .003000  .054772  .342326 .024495  .200000  .100000 70/10/12 81/11/12
                                             TOT     16  .050000  .006667  .081650 1.63299  .020412  .200000  .000000 67/10/20 81/11/12
39340 GAMMABHC   LINDANE     TOT.UG/L                14  .000000  .000000  .000000           .000000  .000000  .000000 67/10/20 79/11/28
                                             K        1  .010000                                      .010000  .010000 80/11/12 80/11/12
                                             TOT     15  .000667  .000007  .002582 3.87298  .000667  .010000  .000000 67/10/20 80/11/12
39343 GBHC-MUD   LINDANE     DRYUG/KG                11  .000000  .000000  .000000           .000000  .000000  .000000 67/10/20 79/11/28
                                             K        5  .160000  .003000  .054772  .342326 .024495  .200000  .100000 70/10/12 81/11/12
                                             TOT     16  .050000  .006667  .081650 1.63299  .020412  .200000  .000000 67/10/20 81/11/12
39350 CHLRDANE   TECH&MET    TOT UG/L                 9  .000000  .000000  .000000           .000000  .000000  .000000 70/10/12 79/11/28
                                             K        1  .100000                                      .100000  .100000 80/11/12 80/11/12
                                             TOT     10  .010000  .001000  .031623 3.16228  .010000  .100000  .000000 70/10/12 80/11/12
39351 CDANEDRY   TECH&MET    MUDUG/KG                 8 4.75000  29.6428  5.44452  1.14622  1.92493  15.0000   .000000 74/06/21 81/11/12
                                             K        3 1.000000 .953E-06 .000977  .000977  .000564  1.00000  1.000000 70/10/12 80/11/12
                                             TOT     11 3.72727  23.8182  4.88039  1.30937  1.47149  15.0000   .000000 70/10/12 81/11/12
39360    DDD     WHL SMPL     UG/L                   14  .000000  .000000  .000000           .000000  .000000  .000000 67/10/20 79/11/28
                                             K        1  .010000                                      .010000  .010000 80/11/12 80/11/12
                                             TOT     15  .000667  .000007  .002582 3.87298  .000667  .010000  .000000 67/10/20 80/11/12
39363    DDD       MUD        UG/KG                  16 9.76250  161.372  12.7032  1.30123  3.17580  42.0000   .400000 67/10/20 81/11/12
39365    DDE     WHL SMPL     UG/L                   14  .000000  .000000  .000000           .000000  .000000  .000000 67/10/20 79/11/28
                                             K        1  .010000                                      .010000  .010000 80/11/12 80/11/12
                                             TOT     15  .000667  .000007  .002582 3.87298  .000667  .010000  .000000 67/10/20 80/11/12
39368    DDE       MUD        UG/KG                  15 4.42666  72.3035  8.50315  1.92089  2.19550  27.0000   .000000 67/10/20 81/11/12
                                             K        1  .100000                                      .100000  .100000 80/11/12 80/11/12
                                             TOT     16 4.15625  68.6533  8.28573  1.99356  2.07143  27.0000   .000000 67/10/20 81/11/12
39370    DDT     WHL SMPL     UG/L                   14  .002143  .000034  .005789 2.70169  .001547  .020000  .000000 67/10/20 79/11/28
                                             K        1  .010000                                      .010000  .010000 80/11/12 80/11/12
                                             TOT     15  .002667  .000035  .005936 2.22606  .001533  .020000  .000000 67/10/20 80/11/12
39373    DDT       MUD        UG/KG                  14 16.7714  1786.27  42.2643  2.52002  11.2956  160.000   .000000 67/10/20 81/11/12
                                             K        2  .100000 .111E-07 .000106  .001057  .000075  .100000  .100000 68/10/25 80/11/12
                                             TOT     16 14.6875  1580.53  39.7558  2.70678  9.93896  160.000   .000000 67/10/20 81/11/12
39380 DIELDRIN               TOTUG/L                 14  .000000  .000000  .000000           .000000  .000000  .000000 67/10/20 79/11/28
                                             K        1  .010000                                      .010000  .010000 80/11/12 80/11/12
                                             TOT     15  .000667  .000007  .002582 3.87298  .000667  .010000  .000000 67/10/20 80/11/12
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EXHIBIT C.4-6 (Cont'd)

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STORET RETRIEVAL DATE 82/06/22  -  INVENT - VERSION OF SEP. 1981
                                                                 01466500
                                                                 39 53 05.0 074 30 20.0  2
                                                                 MCDONALDS B IN LEBANON STATE FOREST NJ
                                                                 34005 NEW JERSEY          BURLINGTON
                                                                                           020691

/TYPA/AMBNT/STREAM                                               112WRD                   02040202000
                                                                  0000  CLASS 00 CSN-RSP 0014708-0186194

INDEX 0208001  002880  00610  0480   0080   0120
MILES 0111.06 0008.61 019.80 003.40 006.40 003.72    .      .        .        .        .
PARAMETER                               RMK  NUMBER     MEAN    VARIANCE STAN DEV COFF VAR STAND ER MAXIMUM  MINIMUM  BEG DATE END DATE
39383 DIELDRIN   SEDUG/KG     DRY WGT          12  .183333  .143333  .378594  2.06506  .109291  1.30000  .000000 67/10/20 81/11/12
                                        K       4  .175000  .002500  .050000  .285714  .025000  .200000  .100000 70/10/12 80/11/12
                                        TOT    16  .181250  .105625  .325000  1.79310  .081250  1.30000  .000000 67/10/20 81/11/12
39388 ENDOSULN   WHL SMPL     UG/L              3  .000000  .000000  .000000           .000000  .000000  .000000 77/11/29 79/11/28
                                        K       1  .010000                                      .010000  .010000 80/11/12 80/11/12
                                        TOT     4  .002500  .000025  .005000  2.00000  .002500  .010000  .000000 77/11/29 80/11/12
39389 ENDOSULN      MUD       UG/KG     K       2  .100000-.372E-08  .000000           .000000  .100000  .100000 80/11/12 81/11/12
39390 ENDRIN                TOT UG/L           14  .000000  .000000  .000000           .000000  .000000  .000000 67/10/20 79/11/28
                                        K       1  .010000                                      .010000  .010000 80/11/12 80/11/12
                                        TOT    15  .000667  .000007  .002582  3.87298  .000667  .010000  .000000 67/10/20 80/11/12
39393 ENDRIN     SEDUG/KG     DRY WGT          11  .000000  .000000  .000000           .000000  .000000  .000000 67/10/20 79/11/28
                                        K       5  .160000  .003000  .054772  .342326  .024495  .200000  .100000 70/10/12 81/11/12
                                        TOT    16  .050000  .006667  .081650  1.63299  .020412  .200000  .000000 67/10/20 81/11/12
39398 ETHION     WHL SMPL     UG/L              5  .000000  .000000  .000000           .000000  .000000  .000000 74/06/21 79/11/28
                                        K       1  .010000                                      .010000  .010000 80/11/12 80/11/12
                                        TOT     6  .001667  .000017  .004082  2.44949  .001667  .010000  .000000 74/06/21 80/11/12
39400 TOXAPHEN                TOTUG/L           7  .000000  .000000  .000000           .000000  .000000  .000000 74/06/21 79/11/28
                                        K       1  .100000                                      .100000  .100000 80/11/12 80/11/12
                                        TOT     8  .012500  .001250  .035355  2.82843  .012500  .100000  .000000 74/06/21 80/11/12
39403 TOXAPHEN   SEDUG/KG     DRY WGT           7  .000000  .000000  .000000           .000000  .000000  .000000 74/06/21 79/11/28
                                        K       2  1.00000  .000000  .000000           .000000  1.00000  1.00000 80/11/12 81/11/12
                                        TOT     9  .222222  .194444  .440958  1.98431  .146986  1.00000  .000000 74/06/21 81/11/12
39410 HEPTCHLR                TOTUG/L          14  .000000  .000000  .000000           .000000  .000000  .000000 67/10/20 79/11/28
                                        K       1  .010000                                      .010000  .010000 80/11/12 80/11/12
                                        TOT    15  .000667  .000007  .002582  3.87298  .000667  .010000  .000000 67/10/20 80/11/12
39413 HEPTCHLR   SEDUG/KG     DRY WGT          11  .000000  .000000  .000000           .000000  .000000  .000000 67/10/20 79/11/28
                                        K       5  .160000  .003000  .054772  .342326  .024495  .200000  .100000 70/10/12 81/11/12
                                        TOT    16  .050000  .006667  .081650  1.63299  .020412  .200000  .000000 67/10/20 81/11/12
39420 HPCHLREP                TOTUG/L           9  .000000  .000000  .000000           .000000  .000000  .000000 70/10/12 79/11/28
                                        K       1  .010000                                      .010000  .010000 80/11/12 80/11/12
                                        TOT    10  .001000  .000010  .003162  3.16228  .001000  .010000  .000000 70/10/12 80/11/12
39423 HPCHLREP   SEDUG/KG     DRY WGT           7  .000000  .000000  .000000           .000000  .000000  .000000 74/06/21 79/11/28
                                        K       5  .160000  .003000  .054772  .342326  .024495  .200000  .100000 70/10/12 81/11/12
                                        TOT    12  .066667  .007879  .088762  1.33144  .025624  .200000  .000000 70/10/12 81/11/12
39480 MTHXYCLR   WHL SMPL     UG/L              1  .000000                                      .000000  .000000 79/11/28 79/11/28
                                        K       1  .010000                                      .010000  .010000 80/11/12 80/11/12
                                        TOT     2  .005000  .000050  .007071  1.41421  .005000  .010000  .000000 79/11/28 80/11/12
39481 MTHXYCLR   MUD DRY      UG/KG             1  .000000                                      .000000  .000000 79/11/28 79/11/28
                                        K       2  .100000-.372E-08  .000000           .000000  .100000  .100000 80/11/12 81/11/12
                                        TOT     3  .066667  .003333  .057735  .866026  .033333  .100000  .000000 79/11/28 81/11/12
39516   PCBS     WHL SMPL     UG/L              7  .000000  .000000  .000000           .000000  .000000  .000000 74/06/21 79/11/28
```

EXHIBIT C.4-6 (Cont'd)

```
STORET RETRIEVAL DATE 82/06/22  -  INVENT - VERSION OF SEP. 1981
                                                        01466500
                                                        39 53 05.0 074 30 20.0  2
                                                        MCDONALDS B IN LEBANON STATE FOREST NJ
                                                        34005 NEW JERSEY          BURLINGTON
                                                                                  020691

/TYPA/AMBNT/STREAM                                      112WRD                  02040202000
                                                         0000  CLASS 00 CSN-RSP 0014708-0186194

INDEX 0208001  002880  00610  0480   0080   0120
MILES 0111.06 0008.61 019.80 003.40 006.40 003.72     *        *        *         *
PARAMETER                                  RMK   NUMBER    MEAN   VARIANCE STAN DEV  COEF VAR STAND ER  MAXIMUM   MINIMUM  BEG DATE END DATE
39516   PCBS     WHL SMPL     UG/L         K          2  .300000  .080000  .282842   .942808  .200000  .500000   .100000 71/10/29 80/11/12
                                           TOT        9  .066667  .027500  .165831  2.48747   .055277  .500000   .000000 71/10/29 80/11/12
39519   PCBS       MUD        UG/KG                   8  1.75000  9.35714  3.05894  1.74797  1.08150  8.00000   .000000 74/06/21 81/11/12
                                           K          2  5.49999  40.4999  6.36395  1.15708  4.49999  9.99999   1.00000 71/10/29 80/11/12
                                           TOT       10  2.50000  14.2778  3.77859  1.51144  1.19490  9.99999   .000000 71/10/29 81/11/12
39530 MALATHN    WHL SMPL     UG/L                    9  .000000  .000000  .000000           .000000  .000000   .000000 70/10/12 79/11/28
                                           K          1  .010000                                      .010000   .010000 80/11/12 80/11/12
                                           TOT       10  .001000  .000010  .003162  3.16228  .001000  .010000   .000000 70/10/12 80/11/12
39531 MALATHN      MUD        UG/KG        K          2  .200000  .000000  .000000           .000000  .200000   .200000 70/10/12 71/10/29
39540 PARATHN    WHL SMPL     UG/L                    9  .000000  .000000  .000000           .000000  .000000   .000000 70/10/12 79/11/28
                                           K          1  .010000                                      .010000   .010000 80/11/12 80/11/12
                                           TOT       10  .001000  .000010  .003162  3.16228  .001000  .010000   .000000 70/10/12 80/11/12
39541 PARATHN      MUD        UG/KG        K          2  .200000  .000000  .000000           .000000  .200000   .200000 70/10/12 71/10/29
39570 DIAZINON   WHL SMPL     UG/L                    9  .000000  .000000  .000000           .000000  .000000   .000000 70/10/12 79/11/28
                                           K          1  .010000                                      .010000   .010000 80/11/12 80/11/12
                                           TOT       10  .001000  .000010  .003162  3.16228  .001000  .010000   .000000 70/10/12 80/11/12
39600 MPARATHN   WHL SMPL     UG/L                    9  .000000  .000000  .000000           .000000  .000000   .000000 70/10/12 79/11/28
                                           K          1  .010000                                      .010000   .010000 80/11/12 80/11/12
                                           TOT       10  .001000  .000010  .003162  3.16228  .001000  .010000   .000000 70/10/12 80/11/12
39601 MPARATHN     MUD        UG/KG        K          2  .200000  .000000  .000000           .000000  .200000   .200000 70/10/12 71/10/29
39730  2,4-D     WHL SMPL     UG/L                   15  .000000  .000000  .000000           .000000  .000000   .000000 68/04/30 80/11/12
39740 2,4,5-T    WHL SMPL     UG/L                   15  .000000  .000000  .000000           .000000  .000000   .000000 68/04/30 80/11/12
39755   MIREX    WHL SMPL     UG/L                    3  .000000  .000000  .000000           .000000  .000000   .000000 77/11/29 79/11/28
                                           K          1  .010000                                      .010000   .010000 80/11/12 80/11/12
                                           TOT        4  .002500  .000025  .005000  2.00000  .002500  .010000   .000000 77/11/29 80/11/12
39758   MIREX     BOT MAT     UG/KG        K          2  .100000-.372E-08  .000000           .000000  .100000   .100000 80/11/12 81/11/12
39760  SILVEX    WHL SMPL     UG/L                   15  .000000  .000000  .000000           .000000  .000000   .000000 68/04/30 80/11/12
39786 TRITHION   WHL SMPL     UG/L                    5  .000000  .000000  .000000           .000000  .000000   .000000 74/06/21 79/11/28
                                           K          1  .010000                                      .010000   .010000 80/11/12 80/11/12
                                           TOT        6  .001667  .000017  .004082  2.44949  .001667  .010000   .000000 74/06/21 80/11/12
39790 MTRTHION   WHL SMPL     UG/L                    5  .000000  .000000  .000000           .000000  .000000   .000000 74/06/21 79/11/28
                                           K          1  .010000                                      .010000   .010000 80/11/12 80/11/12
                                           TOT        6  .001667  .000017  .004082  2.44949  .001667  .010000   .000000 74/06/21 80/11/12
40300 INVALID      PAR        NUMBER                  1  23.0000                                      23.0000   23.0000 68/04/30 68/04/30
70300 RESIDUE    DISS-180   C    MG/L               100  25.5799  70.8724  8.41858   .329109  .841858  52.0000   9.00000 58/03/12 82/01/26
70301 DISS SOL     SUM        MG/L                   93  18.2580  26.6078  5.15828   .282521  .534888  37.0000   11.0000 58/03/12 81/07/15
70302 DISS SOL   TONS/DAY                            99  .281712  1.14312  1.06917  3.79525   .107456  10.7000   .040000 58/03/12 81/07/15
70303 DISS SOL   TONS PER    ACRE-FT                102  .035490  .000175  .013248   .373276  .001312  .100000   .010000 58/03/12 82/01/26
70331 SUSP SED   PARTSIZE    %<.062MM                 8  43.1250  1525.84  39.0620   .905786  13.8105 100.0000   7.00000 80/11/12 82/01/26
70507  PHOS-T     ORTHO      MG/L P                   3  .014000  .000208  .014422  1.03016   .008327  .030000   .002000 73/11/28 75/07/10
                                           K         11  .010000 .465E-10  .000007   .000682  .000002  .010000   .010000 73/02/13 75/06/04
```

EXHIBIT C.4-6 (Cont'd)

```
STORET RETRIEVAL DATE 82/06/22  -  INVENT - VERSION OF SEP. 1981
                                                                                  01466500
                                                                                 39 53 05.0 074 38 20.0  2
                                                                                 MCDONALDS B IN LEBANON STATE FOREST NJ
                                                                                 34005 NEW JERSEY          BURLINGTON
                                                                                                           020691

/TYPA/AMBNT/STREAM                                                               112WRD                   02040202000
                                                                                  0000  CLASS 00 CSN-RSP 0014708-0186194

IND[illegible] 0208001  002880  00610  0480   0080   0120
MILES 0111.06 0008.61 019.80 003.40 006.40 003.72   .      .       .        .
PARAMETER                               RMK   NUMBER    MEAN   VARIANCE STAN DEV COFF VAR STAND ER MAXIMUM   MINIMUM  BEG DATE END DATE
70507  PHOS-T     ORTHO      MG/L P     TOT      14  .010857  .000035  .005908  .544133  .001579  .030000  .002000 73/02/13 75/07/10
71825 T ACDITY     AS H       MG/L                58  .369654  .511091  .714906  1.93399  .093872  5.50000  .100000 65/11/26 82/01/26
                                        K         1  .100000                                     .100000  .100000 76/09/14 76/09/14
                                        TOT      59  .365083  .503911  .709585  1.94363  .092380  5.50000  .100000 65/11/26 82/01/26
71845 AMMONIA    TOT-NH4     MG/L                 1  .000000                                     .000000  .000000 80/11/12 80/11/12
71846 AMMONIA    DISS-NH4    MG/L                 8  .013750  .000113  .010607  .771391  .003750  .030000  .000000 80/11/12 82/03/09
71850 NITRATE    TOT-NO3     MG/L                 1  .100000                                     .100000  .100000 73/02/13 73/02/13
71851 NITRATE    DISS-NO3    MG/L                50  .314000  .191024  .437063  1.39192  .061810  2.00000  .000000 58/03/12 72/09/20
71885   IRON        FE       UG/L                 7  162.857  5357.19  73.1928  .449429  27.6643  290.000  80.0000 68/03/19 69/09/29
71886 TOTAL P     AS PO4     MG/L                16  .024375  .000506  .022500  .923078  .005625  .060000  .000000 79/05/09 82/03/09
71887 TOTAL N     AS NO3     MG/L                29  1.30620  2.23685  1.49561  1.14500  .277728  7.70000  .270000 73/11/28 82/03/09
71890 MERCURY    HG,DISS     UG/L                 2  .100000-.372E-08  .000000           .000000  .100000  .100000 79/11/28 81/05/19
                                        K         2  .100000-.372E-08  .000000           .000000  .100000  .100000 80/05/28 80/11/12
                                        TOT       4  .100000-.372E-08  .000000           .000000  .100000  .100000 79/11/28 81/05/19
71895 MERCURY    HG,SUSP     UG/L                 1  .000000                                     .000000  .000000 79/11/28 79/11/28
71900 MERCURY    HG,TOTAL    UG/L                 4  .050000  .003333  .057735  1.15470  .028868  .100000  .000000 70/10/12 80/05/28
                                        K        14  .442857  .021099  .145255  .327995  .038821  .500000  .100000 74/02/12 81/05/19
                                        TOT      18  .355555  .044967  .212055  .596405  .049982  .500000  .000000 70/10/12 81/05/19
72002 TOP DPTH   WB ZONE       FT                 2  1.11000  .000802  .028320  .025514  .020025  1.13000  1.09000 76/07/15 76/09/14
80020 U-DISS.    EXT.FLR.    UG/L                18  .057222  .008880  .094234  1.64681  .022211  .410000  .010000 67/10/20 80/11/12
                                        K         2  .010000 .727E-10  .000009  .000853  .000006  .010000  .010000 69/03/20 69/03/20
                                        TOT      20  .052500  .008157  .090314  1.72026  .020195  .410000  .010000 67/10/20 80/11/12
80030 ALPHA-D    AS U-NAT    UG/L                20  1.91499  1.06873  1.03379  .539841  .231161  3.80000  .400000 67/10/20 80/11/12
80040 ALPHA-S    AS U-NAT    UG/L                 2  .800000  .179999  .424263  .530329  .300000  1.10000  .500000 69/09/29 77/11/29
                                        K        18  .405555  .000556  .023576  .058132  .005557  .500000  .400000 67/10/20 80/11/12
                                        TOT      20  .444999  .024711  .157196  .353251  .035150  1.10000  .400000 67/10/20 80/11/12
80050  BETA-D    AS SR-Y-    90, PC/L            20  3.01999  3.38277  1.83923  .609018  .411264  7.10000  .700000 67/10/20 80/11/12
80060  BETA-S    AS SR-Y-    90, PC/L             3  .533333  .003334  .057738  .108258  .033335  .600000  .500000 67/10/20 70/09/28
                                        K        17  .423529  .004412  .066423  .156832  .016110  .600000  .400000 68/12/13 80/11/12
                                        TOT      20  .440000  .005684  .075395  .171352  .016859  .600000  .400000 67/10/20 80/11/12
80154 SUSP SED     CONC       MG/L              144  3.45068  42.2743  6.50187  1.88423  .541822  63.9999  .000000 69/01/24 82/01/26
80155 SUSP SED   DISCHARG    TONS/DAY           140  .038571  .024164  .155449  4.03020  .013138  1.60000  .000000 69/01/24 81/09/24
81886 PERTHANE    SED DRY    WGTUG/KG   K         2  .100000-.372E-08  .000000           .000000  .100000  .100000 80/11/12 81/11/12
82068 POTAS-40   K-40,DIS    PC/LITER             5  .240000  .013000  .114018  .475077  .050991  .400000  .100000 80/11/12 81/07/15
82183 2,4-DP     DICLPROP    TOT UG/L             1  .000000                                     .000000  .000000 80/11/12 80/11/12
```

EXHIBIT C.4-6 (Cont'd)

```
[illegible]
'CAS ' RETRIEVES DATA FOR THE PARTICULAR CAS AND TYPE OF DATA
'CREF' RETRIEVES DATA AS IN CAS BUT ADDS COMPLETE REFERENCE
'XREF' RETRIEVES FULL REFERENCE ONLY FOR THE CITED REFERENCE
'RECORD' RETRIEVES A RECORD FOR THE RECORD NUMBER ENTERED
'POSTINGS' GIVES THE DISTRIBUTION OF RECORDS FOR A CAS
'LIST' TELLS IF THERE ARE RECORDS IN CHEMFATE FOR A CAS

 ENTER SEARCH TYPE (ENTER HELP FOR HELP, END TO END)
?CREF
 ENTER CAS NUMBER
 XXXXX-XX-X
?110-80-5
 ENTER DATA TYPE
?LOGP
 ENTER RECORD # FOR UPDATING SEARCH(CR FOR NEW SEARCH)
?
 *******************************************************************************************************************
 CDYN    ETHOXY ETHANOL                                  CAS=  110-80-5     # 1334
      LOG O/W PARTITION FUNCTION:      -.10    #1
 *******************************************************************************************************************
 CREF   110-80-5


       REFERENCES
 HANSCH,C. & LEO,A.J. (1981). MEDCHEM PROJECT.# ISSUE NO. 19.#

 ENTER SEARCH TYPE (ENTER HELP FOR HELP, END TO END)
?HELP
 ENTER 'SEARCH' FOR HELP ON SEARCH TYPES
 ENTER 'DATA  ' FOR HELP ON DATA TYPES
 ENTER 'INPUT ' FOR HELP ON INPUT TYPES
 ENTER 'DEF   ' FOR HELP ON DEFINITIONS & QUALIFIERS
?DATA
 DATA TYPES OF CATEGORIES BELOW MAY BE ENTERED:
 CATEGORIES            DATA TYPES
   ALL,ID
   CDYN         LOGP,PKA,SOIA,UV,VP,WSOL
   TRAN         BIOC,EVAW,HENL,SCOL,SRF
   DEG          ECOS,HYDR,MICD,NSYD,OXID,PHOT
   FSMO         AIRM,BIOM,FIEL,SOIM,WATM

 ENTER SEARCH TYPE (ENTER HELP FOR HELP, END TO END)
?POSTINGS
 ENTER CAS NUMBER
 XXXXX-XX-X
?110-80-5
 POSTINGS IN FILE
 ID       1
 LOGP     1
 VP       1
 WSOL     1
 HENL     1
 NSYD     3
 OXID     1
 WATM     2

 TOT.     11

 ENTER SEARCH TYPE (ENTER HELP FOR HELP, END TO END)
?CREF
 ENTER CAS NUMBER
 XXXXX-XX-X
```

ENVIRONMENTAL FATE DATA BASE
EXHIBIT C.4-7

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best available copy.

```
ENTER RECORD # FOR UPDATING SEARCH(CR FOR NEW SEARCH)
.
*******************************************************************************************************
CLTN    ETHOXY ETHANOL                                    CAS=  110-80-5    # 1734
     LOG O W PARTITION FUNCTION:       -.10   #2
*******************************************************************************************************
CLTN    ETHOXY ETHANOL                                    CAS=  110-80-5    # 2116
     VAPOR PRESS @ 25 DEGC (TORR):       .55E 01 TORR
     VP (TORR):                          .18E 01     .10E 02 TORR   #3
     TEMP (DEGC):                        10.          37. DEGC
     COMMENTS:                          #1 RECOMMENDED VALUE
                                        #2 RECOMMENDED VALUE
                                        #3 TAKEN FROM GRAPHS
     REF:                               DOW CHEMICAL CO. (1981)
*******************************************************************************************************
CSYN    ETHOXY ETHANOL                                    CAS=  110-80-5    # 2117
     WATER SOL @ 25 DEGC (MG/L):          #1
     COMMENTS:                          #1 MISCIBLE
     REF:                               DOW CHEMICAL CO. (1981)
*******************************************************************************************************
CREF   110-80-5



     REFERENCES

 - NO MATCH FOR :    .  DOW CHEMICAL CO. (1981)

 HANSCH,C. & LEO,A.J. (1981). MEDCHEM PROJECT.# ISSUE NO. 19.#

 ENTER SEARCH TYPE (ENTER HELP FOR HELP. END TO END)
?CREF
 ENTER CAS NUMBER
 XXXXX-XX-X
?110-80-5
 ENTER DATA TYPE
?TRAN
 ENTER RECORD # FOR UPDATING SEARCH(CR FOR NEW SEARCH)
?
*******************************************************************************************************
 TRAN    ETHOXY ETHANOL                                   CAS=  110-80-5    # 2118
     HENRY'S LAW CONST (UNITLESS):      .21E 01   #1
     COMMENTS:                          #1 TAKEN FROM GRAPH
     REF:                               DOW CHEMICAL CO. (1981)
*******************************************************************************************************
 CREF   110-80-5



     REFERENCES

 - NO MATCH FOR :    .  DOW CHEMICAL CO. (1981)


 ENTER SEARCH TYPE (ENTER HELP FOR HELP. END TO END)
?CREF
 ENTER CAS NUMBER
 XXXXX-XX-X
?110-80-5
 ENTER DATA TYPE
?LDEG
 ENTER RECORD # FOR UPDATING SEARCH(CR FOR NEW SEARCH)
?
*******************************************************************************************************
```

EXHIBIT C.4-7 (Cont'd)

```
LDEG    ETHOXY ETHANOL                                     CAS=  110-80-5     # 1434
      DEGRADATION IN NATURAL SYSTEMS: INTERMEDIATE REACTIVITY
      SYSTEM:                         AIR
      RATE:                           130 MIN FOR MAX N2
      CONDITIONS:                     SMOG CHAMBER, 1-10 PPM ORGANIC, .1-3.0 PPM NITRIC OXIDE
      REF:                            LEVY,A. (1973)
**************************************************************************************************
LDEG    ETHOXY ETHANOL                                     CAS=  110-80-5     # 1434
      DEGRADATION IN NATURAL SYSTEMS:
      SYSTEM:                         AIR
      RATE:                           NO2 MAX IN 135 MIN
      CONDITIONS:                     SMOG CHAMBER, 12 CU-M, 2 PPM TEST CMPD, 1 PPM NOX, IRRADIATED 700 UW/SQ-CM AND 345-355 NM
                                         LIGHT, 55% REL HUMIDITY, 30 DEGC
      METHOD:                         GC, UV
      REF:                            YANAGIHARA,S. ET AL. (1977)
**************************************************************************************************
LDEG    ETHOXY ETHANOL                                     CAS=  110-80-5     # 3564
      DEGRADATION IN NATURAL SYSTEMS: RAPID DEGR
      SYSTEM:                         WAT
      RATE:                           GT 90% DEGR IN 5.5 DAYS, 3 DAY ACCLIM, 30% COD/DAY CONSUMED
      CONDITIONS:                     BATCH SYSTEM, ACTIV SLUDGE (1 G/L TS), 1000 MG/L COD
      REF:                            ZAHN,R. & WELLENS,H. (1980
**************************************************************************************************
LDEG    ETHOXY ETHANOL                                     CAS=  110-80-5     # 3667
      OXIDATION AND OTHER REACTIONS:
      OXIDANT #1:                     OH RADICAL - PH 9
      RATE #1:                         .10E 10 L/MOL-SEC
      HALF LIFE #1:                    2.19 YR    #1
      CONDITIONS:                     IN AQ SOLN, ROOM TEMP, LITERATURE VALUE FOR OH RADICAL CONC IN WATER 1E-17 MOL/L
      METHOD:                         CHEM
      COMMENTS:                       #1 $CALC
      REF:                            ANBAR,M. & NETA,P. (1967) #
**************************************************************************************************
CREF   110-80-5


      REFERENCES
ANBAR,M. & NETA,P. (1967). A COMPILATION OF SPECIFIC BIMOLECULAR RATE CONSTANT FOR THE REACTIONS OF HYDRATED ELECTRONS, HYDROGEN
     ATOMS AND HYDROXYL RADICAL WITH INORGANIC COMPOUNDS IN AQUEOUS SOLUTION.$ INT. J. OF APPL. RADIATION AND ISOTOPES. 18:493-5
     23.#
LEVY,A. (1973). THE PHOTOCHEMICAL SMOG REACTIVITY OF ORGANIC SOLVENTS.  SOLVENT THEORY AND PRACTICES.$ AMERICAN CHEMICAL SOCIETY
     , WASHINGTON, DC; ADV. CHEM. SER. 124:70-94.#
YANAGIHARA,S.; SHIMADA,I.; SHINOYAMA,E.; CHISAKA,F.; AND SAITO,T. (1977). PHOTOCHEMICAL REACTIVITIES OF HYDROCARBONS.$ PROC. INT
     . CLEAN AIR CONGR.,4TH. PP. 472-7.#

 - NO MATCH FOR :    .  ZAHN,R. & WELLENS,H. (1980)


 ENTER SEARCH TYPE (ENTER HELP FOR HELP, END TO END)
?CREF
 ENTER CAS NUMBER
 XXXXX-XX-X
?2110-80-5
 INCORRECT CAS NUMBER :2110805

 ENTER SEARCH TYPE (ENTER HELP FOR HELP, END TO END)
?FSMO
 NOT CORRECT FORMAT:FSMO :TYPE HELP IF NEEDED

 ENTER SEARCH TYPE (ENTER HELP FOR HELP, END TO END)
?CREF
 ENTER CAS NUMBER
 XXXXX-XX-X
```

EXHIBIT C.4-7 (Cont'd)

```
[illegible]

*****************************************************************************************************
FSMO    ETHOXY ETHANOL                              CAS=  110-80-5    # 3142
NO MATCH IN DICT- FOR WATM
      DATE #1:                               APRIL, 1980
      SITE #1:                               HAYASHIDA R IN TATSUNO CITY, JAPAN
      CONC (DATE #1, SITE #1):                1200. PPB
      METHOD:                                VACUUM DISTILLATION, GC-MS
      REF:                                   YASUHARA,A. ET AL (1981)
*****************************************************************************************************
FSMO    ETHOXY ETHANOL                              CAS=  110-80-5    # 4280
NO MATCH IN DICT- FOR WATM
      DATE #1:                               APRIL 20, 1980
      SITE #1:                               HAYASHIDA R IN TATSUNO CITY, JAPAN  SITE OF LEATHER INDUSTRY
      CONC (DATE #1, SITE #1):                1200. PPB
      SAMPLE:                                VACUUM DISTILLATION
      METHOD:                                GC-MS
      REF:                                   YASUHARA,A. ET AL. (1981)
*****************************************************************************************************
CREF   110-80-5


      REFERENCES
YASUHARA,A.; SHIRAISHI,H.; TSUJI,M.; AND OKUNO,T. (1981). ANALYSIS OF ORGANIC SUBSTANCE IN HIGHLY POLLUTED WATER BY MASS SPECTRO
    METRY.# ENVIRON. SCI. TECHNOL. 15:570-3.#
YASUHARA,A.; SHIRAISHI,H.; TSUJI,M.; AND OKUNO,T. (1981). ANALYSIS OF ORGANIC SUBSTANCE IN HIGHLY POLLUTED WATER BY MASS SPECTRO
    METRY.# ENVIRON. SCI. TECHNOL. 15:570-3.#

 ENTER SEARCH TYPE (ENTER HELP FOR HELP, END TO END)
?END
 #STOP# 0
 YOU ARE CONNECTED TO SYRACUSE RESEARCH CORPORATION'S
          ENVIRONMENTAL FATE DATA BASES.

       TO SELECT THE FILE YOU WISH TO SEARCH
 ENTER DATALOG OR CHEMFATE.  ENTER OFF TO SIGN OFF.
?DATALOG
 #STOP# 0

 RNDATALG RETRIEVES INFORMATION FROM THE
 SYRACUSE RESEARCH CORPORATION DATALOG & XREF FILES

 TYPE HELP FOR HELP    TYPE END TO END

 ENTER SEARCH TYPE
?H
 ENTER 'SEARCH' FOR HELP ON SEARCH TYPES
 ENTER 'DATA  ' FOR HELP ON DATA TYPES
 ENTER 'INPUT ' FOR HELP ON INPUT TYPES
?S
 THE AVAILABLE SEARCH TYPES ARE:
 'CAS'  RETRIEVES DATA FOR THE PARTICULAR CAS
 'MULT' RETRIEVES DATA FOR THE PARTICULAR CAS AND TYPE OF DATA
 'CREF' RETRIEVES DATA AS IN CAS BUT ADDS COMPLETE REFERENCE
 'MREF' RETRIEVES DATA AS IN MULT BUT ADDS COMPLETE REFERENCE
 'XREF' RETRIEVES FULL REFERENCE ONLY FOR THE CITED REFERENCE

 ENTER SEARCH TYPE
?XREF
 ENTER REFERENCE
?HELP
 XREF            HELP
```

EXHIBIT C.4-7 (Cont'd)

```
      REFERENCES

 - NO MATCH FOR :    .  HELP


 ENTER SEARCH TYPE
?HELP
 ENTER 'SEARCH' FOR HELP ON SEARCH TYPES
 ENTER 'DATA  ' FOR HELP ON DATA TYPES
 ENTER 'INPUT ' FOR HELP ON INPUT TYPES
?INPUT
 EXAMPLES OF INPUT ARE:
| CAS          | MULT          | XREF
|  108-93-6    |     90-15-3   | BERTSCH,W ET AL (1974)
|              | BIODEG        | XREF
|              |               | ALEXANDER,M & ALEEM,MIH (1961)
   CREF AND MREF SAME FORMAT AS CAS AND MULT RESPECTIVELY

 ENTER SEARCH TYPE
?XREF
 ENTER REFERENCE
?DOW CHEMICAL CO. (1981)
 XREF              DOW CHEMICAL CO. (1981)



      REFERENCES

 - NO MATCH FOR :    .  DOW CHEMICAL CO. (1981)


 ENTER SEARCH TYPE
?XREF
 ENTER REFERENCE
?ZAHN,R & WELLENS,H. (1980)
 XREF              ZAHN,R & WELLENS,H. (1980)


      REFERENCES

 - NO MATCH FOR :    .  ZAHN,R & WELLENS,H. (1980)


 ENTER SEARCH TYPE
?MULT
 ENTER CAS NUMBER
 XXXXX-XX-X
?110-80-5
 ENTER KEYCODE FOR UPDATING SEARCH(CR FOR NEW SEARCH)
?
 ENTER DATA TYPE
?NSYD
 MULT   110-80-5  NSYD

  NO MATCH FOR ABOVE

 ENTER SEARCH TYPE
?HELP
 ENTER 'SEARCH' FOR HELP ON SEARCH TYPES
 ENTER 'DATA  ' FOR HELP ON DATA TYPES
 ENTER 'INPUT ' FOR HELP ON INPUT TYPES
```

EXHIBIT C.4-7 (Cont'd)

```
 DATA TYPES ARE:  VP  BIODEG  WATER SOL  HENRY CON  EVAP  ECOS  FIEL
  MONIT  ABSORP   UV  BIOCON  O/W PART   PHOTOOXID  DISS CON     HYDROL

 ENTER SEARCH TYPE
?MULT
 ENTER CAS NUMBER
   XXXXX-XX-X
?110-80-5
 ENTER KEYCODE FOR UPDATING SEARCH(CR FOR NEW SEARCH)
?
 ENTER DATA TYPE
?VP
 MULT   110-80-5  VP

 MULT   110-80-5  VP

     CAS        CHEMNAME
   110-80-5  2-ETHOXY ETHANOL

      REFERENCE

 DOW CHEMICAL CO. (1981)
 HANN,RW JR & JENSEN,PA (1977)

 ENTER SEARCH TYPE
?MREF
 ENTER CAS NUMBER
 XXXXX-XX-X
?110-80-5
 ENTER KEYCODE FOR UPDATING SEARCH(CR FOR NEW SEARCH)
?
 ENTER DATA TYPE
?VP
 MREF   110-80-5  VP

 MREF   110-80-5  VP

     CAS        CHEMNAME
   110-80-5  2-ETHOXY ETHANOL

      REFERENCE

 DOW CHEMICAL CO. (1981)
 HANN,RW JR & JENSEN,PA (1977)


       REFERENCES

 - NO MATCH FOR :    .  DOW CHEMICAL CO. (1981)

 HANN,R.W. JR. & JENSEN,P.A. (1977). WATER QUALITY CHARACTERISTICS OF HAZARDOUS MATERIALS.$ NTIS-PB-285946, TEXAS A&M UNI
     V., COLLEGE STATION ENVIRONMENVTAL ENGINEERING DIV. 1751 PP.#

 ENTER SEARCH TYPE
?MREF
 ENTER CAS NUMBER
 XXXXX-XX-X
?110-80-5
 ENTER KEYCODE FOR UPDATING SEARCH(CR FOR NEW SEARCH)
?
 ENTER DATA TYPE
?BOX IODEG
 MREF   110-80-5  BIODEG
```

EXHIBIT C.4-7 (Cont'd)

```
     REFERENCES

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PRICE,KS ETAL (1974)
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    UT. CONTR. FED. 46:63-77.$

- NO MATCH FOR :    .  ZAHN,R & WELLENS,H (1980)


ENTER SEARCH TYPE
?
NOT CORRECT FORMAT:      :TYPE HELP IF NEEDED

ENTER SEARCH TYPE
?END
$STOP$ 0
YOU ARE CONNECTED TO SYRACUSE RESEARCH CORPORATION'S
          ENVIRONMENTAL FATE DATA BASES.

        TO SELECT THE FILE YOU WISH TO SEARCH
ENTER DATALOG OR CHEMFATE.  ENTER OFF TO SIGN OFF.
?OFF
$STOP$ 0

CPU = .8367 CON= 00:23:0  INT = 65 CHG = 0
```

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EXHIBIT C.4-7 (Cont'd)